CREATIVE TRANSFORMATION

A Practical Guide for Maximizing Creativity

"... a new hope and vision of peace for a truly quantum ethical society."

Fred Alan Wolf

JOHN DAVID GARCIA

Creative Transformation

Also by John David Garcia

The Moral Society:
A Rational Alternative to Death (1971)

Psychofraud and Ethical Therapy (1974)

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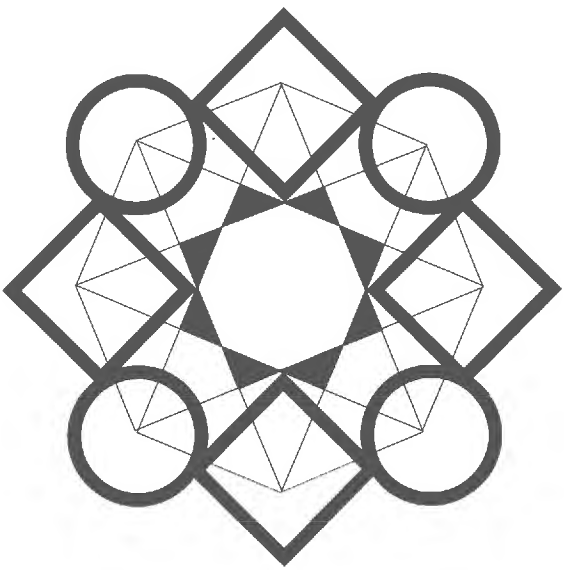

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Preface

Creative Transformation is really two books. The first is a summary of common knowledge and my unconventional, speculative interpretation of this knowledge. I call this "The Evolutionary Perspective." This summary of physical, biological, and psychosocial evolution represents my thinking and my interactions with my students, from whom I learned much, from 1970 through 1983. It is required to understand the more radical, second part of *Creative Transformation*.

In the second part, "The Quantum Perspective," I develop a new theory linking biological evolution, personal creativity, and quantum mechanics. I have called this theory "Creative Transformation." It represents new ideas developed since 1983. The main focus of the second part is to provide a practical, easy-to-follow guide, for anyone who wishes it, to maximize his or her personal creativity and that of others through Creative Transformation.

The process of Creative Transformation has been developed by trial-and-error experimentation since 1970 [280]. It was not until 1984 that I understood the process well enough to begin more systematic experimentation. I now give you the results of all these experiments in the hope of accelerating your own creative transformation and helping you avoid many of the mistakes I made along the way.

Throughout the entire book I mix facts with radical extrapolations from facts in order to make sense of the world and achieve a full synthesis. The only measure of this unorthodox approach is how successful it is in increasing objective creativity for those who understand it. I have tried to make the theory and the practice of Creative Transformation as easy to understand as possible. I hope you will use what you can and correct whatever seems wrong to you. I will be astonished if this book has no errors. However, the type of synthesis being made here can still be worthwhile, even if many of the pieces are in partial error. Do not blind yourself to the beauty of the forest merely because a few trees have been inadvertently marred. We cannot create without risking error. Those who risk no error

create no new ideas. Truth is something that evolves, not a static edifice. If you can, please improve what is here and make it whole. This book is an attempt to correct the errors and extend the truth in my previous books. My next book will be an attempt to correct the errors and extend the truth in this book.

For many centuries many of the best-educated people in the world believed that the utterances of established authority were the best criteria for truth. The scientific revolution has shown us that authority is almost always wrong about almost everything. In 1600, Giordano Bruno was put to death as a heretic because he speculated that just as the sun was the center of our solar system, the stars were distant suns around which revolved planets with living beings on them. Galileo's much milder restatement of this speculation a few decades later, which was limited solely to our solar system, led to his being threatened with torture and execution by the Pope and his subordinates. Galileo was forced to publicly recant what he believed, and we now know is true, in order to avoid torture and death by authorities threatened by new truth.

In our own time we have seen scientific genetics debased in the Soviet Union because it threatened the authority of the Communist Party. We have also seen the theory of biological evolution under constant attack in the United States by religious fundamentalists and their political allies, including the President of the United States, because they felt it threatened their authority. Even the scientific community, which is supposed to be dedicated to truth, hounds and attacks anyone who threatens its authority. This happened when the American Association for the Advancement of Science, under the leadership of the eminent astronomer, Harlow Shapley, pilloried Immanuel Velikovsky and forced a major publisher (MacMillan) to stop distributing his book under threat of boycott by other scientists. I am no fan of Velikovsky, but I deplore this *de facto* suppression of ideas no matter how wrong they may be. Today, most scientists disparage and refuse to listen to anything that smacks of mysticism, while mystics disparage scientific method as being irrelevant to their truth. Each authority claims to be the sole source of truth and in the process destroys truth for all humanity.

The lay public does not realize that this happens all the time within the scientific community itself. It happened to Einstein when classically minded physicists, including Nobel laureates, disparaged relativity as "Jewish Physics" and when relativitists disparaged quantum mechanics as "spooky," to use Einstein's own word. It happens today among evolutionary scientists who militantly support one theory of evolution over another. This is the conflict between gradualists and catastrophists. Even so eminent a scientist as Fred Hoyle cannot get other scientists to listen to, let alone consider, his highly original, theoretically plausible, and experimentally testable radical ideas about evolution—which I do not share, but

respect. An equally eminent physicist, David Bohm, has the most coherent and scientifically elegant model for integrating relativity and quantum mechanics that seems uniformly superior to the currently fragmented approaches to these subjects. Yet the scientific community ignores it because it seems a radical, speculative departure from authoritative orthodoxy.

Too many of those who presume to be champions of truth live in fear of being ostracized by their peers for embracing or even considering an idea not sanctioned by the conformist authority of their community. Instead of expanding truth they become guardians of a *status quo* that destroys truth and punishes those who violate the popular prejudices of their peers.

All civilizations ultimately destroy themselves because too many of their members become afraid of new ideas, instead of playing with them to see whether they may be true. The playful generation and contemplation of new ideas is the basis of creativity. Ever growing creativity is essential for any civilization's survival—including our own.

I have done my best to ignore the popular prejudices of both the scientific-technocratic community and the humanistic-mystical community in a search for an understanding of the basic causes and the interrelationships between creativity, ethics, and evolution. The conclusions I have reached are radically different from what is currently popular or acceptable. However, it meets the only test I have for truth. It presently works and works extremely well in apparently making solely correct predictions with no incorrect prediction of reality. Above all, it leads to an enormous increase in the ability of each human being who wishes it to expand his or her own objective creativity and help all humanity do the same. This does not mean that this general model, which I call the "Theory of Creative Transformation," cannot be improved or that it has no flaws in it. It merely means that all truth is incomplete. Anyone who closes his or her mind to an objectively testable theory and technique for maximizing creativity merely because it goes against current popular prejudice cares little for truth or creativity and lives only for the illusion of security produced by conforming to popular belief. This book is written solely for those who value truth more than happiness and are prepared to stand alone, if necessary, in the pursuit of truth.

Many persons have helped me, including those who opposed me and disagreed with everything I believed. I would like to personally thank those who have been most helpful along the way. At the same time, I do not wish to imply that these persons are in any way responsible for any mistakes I may have introduced into the creative transformation process. I owe them much for what is valid. I alone am responsible for whatever may be invalid. Some of these persons may still disagree with my current work.

For their help in the early part of my work, I wish to thank Sandra Hass, Mary Ward, Michael Meredith, Joe and Betty Demkin, Humberto Fernandez Moran, as well as Prudenzia and Arthur Ceppos. For their help

in the latter part of my work, I would like to thank Amit and Maggie Goswami, Evelyn Lee, Guillermo Sanchez, Joy McKee, Mike Hatton, Susan and Robert Elder, Geoff and Terese Hughes, Janine Offett, Bob and Debbie Sandersfeldt, Cate Coughlin, Gloria Starr, Terry Orbeck, Anne Montgomery, Warren and Sonia Adler, Susan Walden, Jetti and William Alsdorf, Mary Kay Brent, Jeff Melcher, Sharon and Jordan Michels, and Gary and Jeanne Cook. Special thanks go to Ron Wolfe, Mike Allen, Isabel Gomez Cardona, Lorraine Miller, and Sonia Sujo for helping me prepare the manuscript of this book. For their help in editing the manuscript and preparing the book for publication, I give deepest thanks to Peter J. Dorman and Russell Becker. I wish to express my deepest appreciation to my publisher, Tony Parrotto, whose help and support since 1973 have been an essential contribution to whatever is of value in my work. Many other persons have also helped me. I thank you without naming you.

Most of all, I wish to thank my beloved wife, Bernice, whose love and support have sustained me through many difficulties since 1959. Thank you, Bernice, for being both my complementary pair and my catalyst. Thank you for Miriam, Karen, Elizabeth, and Laura, who are our equal and joint creation. You are a part of all I create.

—John David Garcia
Fall Creek, Oregon
February 20, 1990

Creative Transformation

Introduction

The purpose of this book is to teach a practical, scientific method for maximizing creativity. Creativity is, among other things, the process by which we discover scientific laws, invent machines, produce works of art, and help others do the same. The most creative thing we can do is to help maximize the creativity of another. It will be shown that in so doing we maximize our own creativity. In teaching this method we will always use science as the ultimate criterion for truth, while recognizing that creativity and new truth require more than science. We use science only to separate truth from delusion. If we are to maximize creativity, we must first learn to integrate science, mysticism, evolution, ethics, art and other concepts in a new holistic paradigm of reality.

Paradigms

It comes to pass for all civilizations that either they change their collective paradigm of the universe or they die. In the past, all have chosen to die. It appears that Western civilization is being forced into the same choice today.

A "paradigm" is a comprehensive model of reality that enables us to relate to the world around us and have a sense of identity within what we perceive to be "the real world." Many persons feel that their identity is threatened if they have to change their beliefs in any way. They, therefore, will fight to the death to hold on to false beliefs. This is the basis of religious and ideological wars in general. Truth is not so easily threatened.

Only self-deluded persons feel their identity (ego) is threatened by the admission that they are in any way wrong. They will then deceive themselves to the point of hallucinating total distortions of reality in order to hold on to their false beliefs. A minor case in point is a now classical experiment in which persons are shown a deck of cards whose hearts are all black and spades are all red. Their paradigm is such that even after being shown the cards repeatedly, they cannot tell that the colors have been reversed: the simple paradigm that hearts are always red and spades are always black is so fixed in their minds that they cannot change it even after repeated observations that it has in fact been changed.

When this type of conflict comes to more important and fundamental beliefs such as who we are, where we come from, where we are going, and how we can get there, the resistance to paradigm change is much greater. Yet we are constantly being forced to change our most cherished beliefs by unavoidable, overwhelming reality. We can continue to learn only when we admit that we might be wrong. We learn much more when we recognize our errors than when we confirm our beliefs. Persons fear discovering their errors only when they desire happiness more than truth; otherwise they delight in discovering their errors.

In relatively recent history many of the people of Europe were forced to change their paradigm of the Catholic Church as a moral source of infallible truth. Those who did so created the scientific revolution and produced modern Western civilization. Those who could not change this paradigm were left behind and saw their countries undergo a sharp decline relative to the Protestant, or later secular, countries that resulted from the Reformation and the acceptance of scientific method as the ultimate arbiter of objective truth.

But no sooner was the Newtonian model of the world fully established and generally accepted by the end of the 19th century than science forced us again to change our paradigm twice in one generation—first, to the relativistic model of reality, and then to the quantum view of reality. Not even the greatest scientist of his generation, Albert Einstein, was able to accept the quantum paradigm of reality, which seems so contrary to intuition, common sense, and rational determinism, but which shall be shown to be the key to the holistic paradigm.

Copernicus, Galileo, Newton, and the other creators of the scientific revolution had demolished the authority of the Catholic Church in the physical universe. Darwin and modern science in general apparently demolished all religious authority in the natural world. The religious fundamentalists in the United States and other countries still have not reconciled themselves to this state of affairs. Quantum mechanics went further and implied to some that there might not be any underlying order at all to the universe. In the words of Jacques Monod [531], everything occurs because of chance and/or necessity. Personal choice as well as moral order in the universe may be illusions. These last, apparent implications of quantum mechanics were so contrary to Einstein's moral sense of propriety that he rejected the basic premises of quantum mechanics altogether and looked elsewhere for other explanations for quantum phenomena.

Quantum Mechanics

Quantum mechanics has two basic premises which are counterintuitive to most persons. The first is that nature, at its core, is random. The second is that there is a fundamental, unavoidable interaction between the observer

and nature so that it is not possible to observe any part of nature without changing what we are observing by the very act of the observation. Einstein responded to the first premise by saying that "God does not play dice with the Universe." He responded to the second premise by saying that "God is subtle but not malicious."

Einstein was a man of such great genius and creativity that the scientific community should have listened carefully to what he was saying. Instead, they chose to ignore him during the last quarter of his life, in spite of his public acclaim. But as we shall later see, Einstein may yet have the last word on this subject. Einstein's notions that quantum mechanics was an incomplete science and that quantum phenomena were due to hidden variables are now supported by increasing evidence, except that the hidden variables appear to be outside of our time and space (i.e., they are "nonlocal") and are intimately tied to the human mind [299, 836]. Einstein would have found this notion even more shocking than the basic premises of quantum mechanics, but perhaps not as spiritually disturbing. An infinite, noetic [see Glossary] universe filled with true information, outside of our time and space, is a belief all mystics have in common. Some personalize this belief and call it "God."

Science

The scientific disdain for Einstein's views was not out of spite or malice, but because quantum mechanics fit the most fundamental paradigm of science, which may be summarized as follows:

Definition 1: *Information* is the symbolic representation of events and their relationships.

Definition 2: *Truth* is any information which, when we believe it, increases our ability to predict and/or control any part of the objective world without decreasing our ability to predict and control any other part of the objective world.

Definition 3: *Falsehood* is information which, when we believe it, decreases our ability to predict and/or control any part of the objective world.

Definition 4: The *objective world* is the commonly observable and measurable environment—physical, biological, and psychosocial.

Definition 5: To *predict* is to imagine an event correctly before it is objectively perceived.

Definition 6: To *control* is to deliberately cause a predicted event how and when we imagine it.

Definition 7: *Falsifiability* means that alleged scientific statements must be objectively testable to see whether they are in fact false. Untestable statements about nature are at best trivial, at worst meaningless, but they need not be tested immediately.

Note: The essence of scientific method is experimental verification of theories and hypotheses (that may often be playfully generated). Any hypothesis or theory which fails to predict what it claims it can predict is considered false. No hypothesis or theory is ever regarded as absolutely true or beyond doubt. In fact, it is expected that all theories will eventually be replaced by truer theories in an unending process of scientific evolution through creative play with new ideas. "Truer" theories make more numerous and/or more accurate predictions.

Quantum mechanics was excellent at predicting the chemical behavior of atoms and molecules. It led to such practical devices (control) as lasers, microchips, and superconductors. Although quantum mechanics could not precisely predict or control the behavior of individual quantum events such as determining the simultaneous, precise position and momentum of electrons and protons or of electronic exchanges between atoms in a molecule, it predicted very precisely the average interaction of millions of these quantum events, as in the inventions mentioned above and in many thousands of reported experiments. Therefore, the scientific paradigm said that the Theory of Quantum Mechanics must be true, despite such unanswered questions as how a quantum object is simultaneously both a wave and a particle even though it can be observed as only one or the other. Richard Feynman and David Bohm, both renowned physicists, have each claimed, for different reasons, that quantum objects are in fact particles, not waves, although we may observe them as either [63, 241]. Some physicists are beginning to see a connection between quantum mechanics and mysticism [100, 299, 858].

Mysticism

There is a reality in the universe other than scientific truth. This is the reality of our subjective perceptions, feelings, thoughts, intuition, and mystical insights. Science may help us distinguish which of our subjective beliefs are objectively true or false, but it cannot generate new objective information about anything independently of our subjective imagination. All truth begins as a new, unproven, subjective idea which seems true to at least one person but which many others may feel is false because it violates their paradigm. Science is an aid to, not a substitute for, creative thought.

Science cannot replace our conscience, our inner sense of right and wrong. It will be shown that no matter what the scientific evidence to the contrary, we should never do things we believe to be wrong. This is why Einstein could never accept quantum mechanics as it had been formulated—it went against his conscience. Although Einstein was not religious in the orthodox or conventional sense, he publicly stated that he believed in the God of Spinoza, an impersonal God of reason and coherent order who did not play dice with the universe nor play malicious tricks with

his creations. Another great scientist who like Einstein was a major contributor to quantum mechanics, and yet could not accept its full implications, was Erwin Schroedinger, who won a Nobel Prize for deriving the quantum mechanical wave equation. Schroedinger's famous pronouncement on quantum mechanics was, "I don't like it, and I am sorry I had anything to do with it." Guided by his conscience, Schroedinger was also a deeply religious man in the mystical sense.

Ken Wilber, in his book *Quantum Questions*, has shown that some of the greatest scientists of this century have been deeply religious in the mystical sense. It will be shown that pure science devoid of mysticism as well as pure mysticism devoid of science are often sterile deadends that impede creativity. In order to be maximally creative, it is necessary to make a full synthesis between science and mysticism, as well as other concepts. This requires a radical restructuring of paradigms by scientists, mystics, and the world in general. If it is not done, humanity will probably annihilate itself, as has been independently shown [280]. It is the purpose of this book to fully integrate the mystical and scientific paradigms through ethics and evolution within the context of maximizing creativity.

Mysticism means many different things to different people. What seems to be the common denominator among all mystics from Buddha, Jesus, Spinoza, Mahatma Gandhi, and Mother Teresa to their scientific counterparts in Kepler, Newton, Einstein, Schroedinger, Pauli, Jung, Heisenberg, and Teilhard de Chardin is that they all believe in the following paradigm—the Mystical Paradigm:

1. There is a moral order to the Universe.
2. There is a greater source of truth in the Universe than humanity; it produces, at least in part, the moral order of the Universe.
3. Humanity can communicate with the common source of moral order and greater truth.
4. Being ethical facilitates, and may be essential to, this communication.

Almost all persons who are in any way religious can accept the preceding paradigm, although many will try to restrict it further by adding such notions as a personal God and specific formulae for communicating (praying) with this personal God. However, science excludes the mystical paradigm from its own paradigm, since the overwhelming majority of scientists, including those who are religious, cannot see how mysticism is relevant to science. That is to say, many scientists cannot see how any form of mysticism can lead to an increase in their ability to predict and control in the objective world. Nonmystical scientists see all forms of mysticism as synonymous with superstition. "Superstition" may be defined as "other peoples' religious beliefs." Similarly, many mystics reject science because

they cannot see how science can help them better communicate with God, a subjective experience they perceive directly. This state of affairs produces the following kinds of persons:

Definition 8: *Mystical Specialists* are persons who reject science as having any relevance to their own reality, which is the reality of their own thoughts and experiences; they specialize in predicting and controlling their own thoughts and ignore as much as possible the objective world. They value experience more than action.

Definition 9: *Mystical Scientists* are persons who make a sharp separation between science and mysticism. They are nonmystical in their science and nonscientific in their mysticism, but accept both paradigms for different aspects of their life. They may belong to and practice an orthodox religion while being very rigorous scientists in a specialized field. They are usually less creative than those who fully integrate science and mysticism, but are often more creative than the Mystical or Scientific Specialists because they are more open to all aspects of truth.

Definition 10: *Scientific Specialists* are scientists who reject mysticism in its entirety and accept only the scientific paradigm. They are typically strict reductionists in science and see human beings strictly as biological systems whose behavior is determined entirely by physical laws and by conditioning—Neo-Darwinists, Skinnerian Behaviorists, and Orthodox Marxist-Leninists are examples of persons who see themselves this way. Scientific Specialists may be as dogmatic, destructive, and uncreative as the mystical specialists. They, like all persons, are creative insofar as they have ethical integrity and value truth more than happiness. As with other specialists, Scientific Specialists also become destructive when they assert that their paradigm is complete.

Definition 11: *Scientific Mystics* are persons who fully integrate science and mysticism. They accept both paradigms in a holistic way and are mystical in their science as well as scientific in their mysticism. Kepler, Newton, Einstein, Schroedinger, Pauli, Jeans, Eddington, Heisenberg, and many other highly creative scientists have been scientific mystics. Not only scientists, but everyone from carpenters, potters, and gardeners to cooks, mechanics, and artisans are also more highly creative in their crafts and in all aspects of their life when they are Scientific Mystics. Scientific Mysticism is a state of mind, not a profession. Any person—not just the formally trained scientists and mystics—who accepts the holistic paradigm is in fact a Scientific Mystic. It will be shown that creativity is directly proportional to how well persons integrate science with mysticism in a holistic paradigm that combines the totality of human experience realistically and openly, objectively and subjectively, esthetically and ethically. This is the Holistic Paradigm.

Definition 12: Finally, there are *Existentialists,* who often claim to reject both the scientific and the mystical paradigms; they see no pattern,

meaning, or purpose in a universe which is then dogmatically asserted to be meaningless and absurd.

The major values of existentialists are beauty and intellectual integrity in not deceiving themselves into believing what is not true. This applies in particular to their own motivations. Existentialists do what they do because they value experience as an end in itself. Just being oneself and recognizing that one's own experience is a sufficient end in itself are central to existentialism. Existentialists are often highly intelligent and artistically creative. They are exemplified by Albert Camus and Jean Paul Sartre. Jacques Monod was a scientific existentialist [531]. However, it seems to me that existentialists are often as self-deluded as the mystical specialists and share what is in fact a similar value system—giving primacy to their subjective experience as the only reality that exists or matters. Nihilism is the most destructive form of existentialism since it rejects the notion of any ethical obligation at all, thereby producing *de facto* psychopaths. Many existentialists believe at least that they have an obligation to the intellectual integrity of others as well as to their own. They may often show social responsibility, albeit of a very limited kind. The most creative artists and scientists are usually open to both the scientific and the mystical paradigms. They are rarely existentialists. Monod and renowned cosmologist Stephen Hawking [328] are exceptions. They, and a few of their peers, seem to integrate both the existential and the scientific paradigms in an austere, lonely ethical system which limits their considerable creativity by denying the mystical paradigm, but which gives them ethical integrity and keeps them creative by valuing truth above happiness. The ultimate weakness of existentialism comes from valuing personal experience more than ethical action. No society is viable which does not give primacy to creative, ethical action over personal experience.

Creativity

One proposition to be developed in this book is that any form of specialization is ultimately destructive, and that, by leading to its own self-improvement, scientific mysticism is the only realistic paradigm that can avoid internal contradictions and maximize creativity. Scientific mysticism (the Holistic Paradigm) is the only fully generalized paradigm that seeks to integrate all aspects of reality. It may, in fact, be essential to human survival. However, only persons who put maximum value on creativity can become scientific mystics. Scientists such as Monod and Hawking put a higher priority on not deceiving themselves. This is often a manifestation of fear, and as such it limits their creativity. We can, with difficulty, be scientific mystics and avoid self-delusion. It is a risk many otherwise creative persons decline.

Self-delusion is the risk we take in order to maximize creativity. There

is no progress without some risk. The fear of risk takes us to specialization and stagnation. As soon as we open ourselves to mysticism, we also open ourselves to self-delusion. The world is full of self-deluded mystics, specialized scientists, mystical scientists, and existentialists who believe that they are creative when in fact they are destructive to themselves as well as others. This is where scientific method is most useful. If we are in fact creative, then our actions must be increasing someone's ability to predict and control part of the objective world without decreasing this ability for anyone else.

Definition 13: *Creativity* is the act of increasing truth for at least one person (including ourselves) without decreasing truth for any person (including ourselves).

This precludes stopping at the prediction and control of our own thoughts (the subjective world) and calling that act creative. If we bring about subjective changes in ourselves or others, they are creative if and only if they lead to increased truth about the objective world for at least one person without decreasing truth for any person. So long as our information is purely subjective, we must remain open to the possibility that our information may be objectively wrong. We test subjective information by scientific method. Mysticism gives us only subjective information. It is not necessarily true or false. Science tells us whether any subjective information is objectively false according to the scientific paradigm. However, science *never* allows us to discover new truth of any kind directly. It can only test information to see whether it is false in the first place, and then communicate this information in a coherent way to others. If the information is not false, it is assumed to be tentatively true until "truer" information is available. Any information which makes any false predictions is either false or incomplete. The best we can ever hope to discover through science is true—but incomplete—information. All paradigms are either false or incomplete. Scientific Mysticism is an evolutionary paradigm that leads us toward an ever truer and more complete paradigm in an infinite process of ever increasing creative imagination guided by ever increasing objective truth.

Remember that science never gives us absolute truth that cannot be improved. All new truth begins as subjective information in someone's mind. But this is also how all delusion begins. In order to distinguish between truth and delusion, we must use scientific method, which is simply doing a suitable experiment to test our alleged model of truth. The design and execution of any "suitable" experiment is in itself a creative act, since it increases truth.

Creativity is, therefore, the act of producing new information and testing whether it is objectively true. The scientist does this through experimentation that shows that his theory or hypothesis predicts correctly with no significant errors; the engineer by building a new machine that works (controls) as predicted; the educator by teaching information that in fact

improves the student's ability to predict and control in the objective world; the healer by in fact curing an illness and producing health; the nurturer by maintaining health and enhancing growth; the parent by having, loving, nurturing, and educating children; the artisan by making an object that can be used to enhance truth for at least one person; and finally, the artist by producing a work that is perceived as beautiful. "Beauty" is the conscious perception of objective truth being communicated to our unconscious. The greater the truth communicated to the unconscious, the more beautiful the art. Therefore, creativity has many—in fact, infinitely many—manifestations in the objective world. "Science," in the broadest sense, is the objectification of creativity. We can all be scientists in this sense of simply testing our alleged models of how to increase creativity. The desire to increase and the act of increasing creativity I call "ethics."

Ethics

"Ethics" is usually defined as the study of what is "good," or as a set of moral values or principles. These definitions mean that one person's ethics can be another person's evil. My approach to ethics is universal in the mathematical sense of being optimal for an ultimate set of values, i.e., an extremal in a desired direction. It will be shown that there are only two ultimate values and that all actions are ways of achieving one or both of these two ultimate values. The first value I call "happiness." The second value we have called "creativity."

Definition 14: *Happiness* is a subjective state of mind in which we believe that our desires are being fulfilled. Desires that have been fulfilled do not make us happy; only desires that are being fulfilled make us happy.

We all have multiple desires, not all of which can be simultaneously fulfilled. Unfulfilled desires make us "unhappy." Therefore, we are all both happy and unhappy at the same time. When the rate, strength, and number of desires being fulfilled exceeds the rate, strength, and number of desires not being fulfilled, we call the net result "happiness." The converse we call "unhappiness."

For those seeking happiness, the question "Why do you wish to be happy?" makes no sense because happiness is an ultimate goal and not a means toward any other end. Therefore, it is obvious that happiness is an ultimate end. It is not so obvious that creativity is also an ultimate end, but it shall be shown that it is.

The first thing to note is that happiness and creativity are not mutually exclusive. By definition, if our strongest desire is to maximize creativity, then the maximization of creativity is what makes us happiest, given that all other desires are not totally unfulfilled. However, creativity and happiness are obviously not synonymous, since happiness is a subjective state of mind, while creativity is an objective act. Our animal nature,

which is reflected through the desires of our lower three brains (the mammalian cortex, the reptilian complex, and the hindbrain or fish brain), and which we share to lesser or greater degrees with all other animals, predisposes us to be happy. Each brain reflects its own desires, which are usually tied to the basic needs to survive, reproduce, metabolize, and provide for the welfare of our progeny—and nothing else.

The neocortex, which is developed most highly in human beings, although it exists to a lesser degree in all the higher mammals—particularly the primates, cetaceans, and elephants—manifests needs and desires that have little immediate relationship to survival, reproduction, metabolism, or nurturing of progeny. The neocortex contains our center for ethics and creativity. Darwinists have trouble explaining ethical behavior because much of ethical behavior seems contrary to survival. No other animal will knowingly die for ethical principles. At best, some higher mammals will risk their lives to save their young. We will show why ethics are essential to human evolution and why the continuation of evolution is more important in nature than personal survival. This will necessitate a change in the Darwinian paradigm.

The destruction of the frontal lobes in the neocortex destroys our capacity both to make ethical judgments and to display creative imagination, although it does not destroy basic reason or intelligence. Therefore, our biological capacity for ethics and that for creativity are neurologically linked within the frontal lobes of the brain and are interrelated by the notion that ethics are our desire to maximize creativity. Ethics, which are our highest need, evolved last. Formally we define ethics as follows:

Definition 15: "Good," or *ethical*, is any act or thing which increases creativity for at least one person, including oneself, without decreasing it for any person, including oneself.

Definition 16: "Evil," or *unethical*, is any act or thing which decreases the creativity of any person, including oneself.

Definition 17: The *Universal* or *Evolutionary Ethic* is that we must do our best to maximize creativity for ourselves and others.

It is a natural consequence of normal human development that at some point in our childhood our desire for creativity becomes as strong as all of our other desires combined. This course of development can only be impeded by extremely destructive measures such as neurosurgery (e.g., a lobotomy), drugs, or extreme deprivation such that the lower desires are never properly satisfied. Most commonly, *all* human societies destroy our natural desire for creativity by punishing creative behavior and rewarding noncreative behavior. Although this type of destructive conditioning is ultimately fatal to society, it is the most common feature of all civilizations up to the present. Why it occurs and how to overcome this phenomenon is a major topic of this book.

Maslow's notion of the hierarchy of needs [500, 501] seems to apply

here, except that I would call the highest need "the desire to maximize creativity." The satisfaction of this need is what leads to self-actualization. We become self-actualizing when we choose to live by the Evolutionary Ethic, not by desiring to be self-actualizing. Furthermore, we can deliberately and consciously choose to follow the Evolutionary Ethic, then fulfill other needs only insofar as they are necessary for us to comply with the Evolutionary Ethic. We can make that choice when the strength of our ethical needs equals the strength of all of our other needs combined. When we make this choice, consciously or unconsciously, we become ever more ethical. When we refuse to make this choice or when we choose the opposite, consciously or unconsciously, we become ever less ethical. Ethical behavior, therefore, results from the strength of our desire for creativity as an act relative to the strength of our desire for happiness purely as a subjective mental state.

Following the Evolutionary Ethic is a uniformly optimal strategy that will maximize both happiness and creativity because, when we follow the Evolutionary Ethic, our desire for creativity becomes ever stronger and easier to fulfill relative to other desires, as we become ever more creative. If we seek to maximize happiness directly, we end up with neither happiness nor creativity because by seeking to maximize happiness directly we will always seek to satisfy whatever desires are strongest at the time, with little or no concern as to how this satisfaction will affect anyone's creativity, including our own. Ultimately, persons wishing to maximize happiness directly (hedonists) develop as their strongest desire the desire for desire. This is because desires that have been satisfied can no longer make us happy. The unending desire for desire can never be satisfied. This in turn leads to its own contradiction such that the main concern of all hedonists becomes not to be unhappy. Unfulfilled desires make us unhappy. The easiest way to eliminate unhappiness is to eliminate desire. The easiest way to eliminate desire is to die. Therefore, persons who wish to maximize happiness directly end up wishing for their own deaths indirectly, thereby minimizing both happiness and creativity along with unhappiness. This, like all risk-minimizing strategies based on fear, leads to extinction. Such persons are the reason why all civilizations in the past, and apparently our own civilization today, have chosen death.

For these reasons we maximize both creativity and happiness by seeking to maximize creativity with no concern for our happiness or that of others. That is why following the Evolutionary Ethic is a uniformly optimal strategy that will get us everything we want better than any other strategy. It is the only ethical principle that is fully generalized and viable in the long run. This now enables us to state the fundamental equation of Creative Transformation.

The Equation of Creative Transformation

This is the simplest equation that satisfies the boundary conditions of the process. It is clearly an approximation. Ethics (E) and Intelligence (I) are not fully independent, e.g., Intelligence (I) goes to infinity as Ethics (E) goes to 1, although Intelligence (I) can increase up to a point without Ethics increasing.

EQUATION 1: $C = IE$

Where: C = Creativity in quanta of new, true information generated per unit time. Range is minus infinity to plus infinity.

I = Intelligence in quanta of old, true information predicted and controlled per unit time. Range is zero to plus infinity.

E = Ethics in units of desire for truth minus units of desire for happiness without truth, the entire quantity divided by total units of desire. Range is -1 to +1.

Or $E = (Yt - Yf)/(Yt + Yf)$

Where: Yt = Quanta of new, true information imagined per unit time. Range zero to plus infinity.

Yf = Quanta of new, false information believed per same unit time as Yt. Range zero to plus infinity.

Definition 18: *Negative creativity* is destructiveness which results from negative ethics, i.e., desiring happiness more than creativity. *Destructiveness* is the generation of false information or the elimination of true information.

Therefore, if a person is ethical, then $1 > E > 0$, and the person is creative. If a person is unethical, then $-1 < E < 0$, and the person is destructive.

Definition 19: *Self-delusion* is believing information that is false. It is not necessary to believe false information, because we do not need to believe anything. We can be effective by taking a probabilistic approach to life. We believe falsehood only when we behave unethically. We can always choose to suspend belief.

When we value happiness more than truth or creativity, we will believe falsehoods which will enable us to continue to believe other

falsehoods that make us happy in the face of contradictory evidence. That is why true information imagined minus false information believed, divided by all information imagined and believed is a measure of a person's ethics. The following corollaries follow directly from Equation 1, and the related Definitions. Equation 1 is derived and treated more completely in the rest of the book.

Corollary 1.0: The more unethical persons are, the more rigid their belief system, and the less likely they are to doubt their beliefs.

Corollary 1.1: It is ethical to doubt.

Corollary 1.2: It is unethical to be certain.

Corollary 1.3: Ethical persons always consider that their information may be in error, and are desirous of testing their information through scientific method in direct proportion to how ethical they are.

Corollary 1.4: Ethical persons take their identity not from their beliefs or experiences, but rather from their ethical actions, i.e., from doing their best to follow the Evolutionary Ethic. Ethical persons are goal-oriented, not method-oriented, while recognizing that unethical means can never achieve ethical ends. The means must be ethical ends in themselves.

Definition 20: If $E = 1$ for any person, and that person never behaves unethically again, we define such a person as *moral*.

Morality is the desire and the act of predicting and controlling our own ethics, just as ethics is the desire and the act of predicting and controlling our own intelligence.

Definition 21: *Intelligence* is, intuitively speaking, the ability to predict and control the total environment—physical, biological, and psychosocial.

Prediction and control are always partial, never total. We all predict and control only part of the total environment, and fail to predict or control in other parts of the environment. We all have finite intelligence.

Corollary 1.5: An ethical person focuses on predicting and controlling only what enhances the creativity of all. An ethical person does not interfere with the individual choices of others except in self-defense, because to do so diminishes the creativity of all. Ethically, we must speak only what we believe might be true, but we are also ethically constrained from imposing our truth on others. Nothing destroys the creativity of others more than to take away their opportunity to freely make ethical choices. By expanding the creative options for others in an atmosphere of freedom, ethics will flourish and evil will destroy itself.

From Equation 1, it follows that unethical persons ($0 > E > -1$) are more often destructive than creative in their lives, but not devoid of creativity, while ethical persons ($1 \geq E > 0$) are more creative than destructive in their lives, but not devoid of destructiveness.

Definition 22: Only *immoral* persons ($E = -1$) are defined to be solely destructive and never creative again after $E = -1$.

Definition 23: A *trivial* person ($E = 0$) is a person whose net effect in life is to destroy and create equally, or to do nothing.

Corollary 1.6: Trivia is a set of measure zero, i.e., almost all acts are either ethical or unethical.

Corollary 1.7: Inaction is unethical.

Corollary 1.8: The best way to maximize creativity is to maximize ethics first and intelligence second.

Corollary 1.9: To increase the intelligence of an unethical person is unethical, i.e., destructive; it is unethical to tolerate destructive behavior by failing to take action against it.

Corollary 1.10: It is not possible to increase ethics without simultaneously increasing intelligence.

Corollary 1.11: It is possible to increase intelligence without increasing ethics; all such acts are suboptimal or unethical.

Theorem 1

By helping persons become moral, we help them achieve infinite potential creativity. In other words, no matter how low their initial intelligence, *they will achieve potentially infinite creativity if they can become moral.*

Explanation 1

Becoming moral is valuing truth above happiness in an absolute sense. It is a state of mind where all desires, including the desire for self-preservation, are secondary to the desire for maximizing creativity. It follows from Equation 1 and from the definition of ethics that if $E = 1$, then a moral person cannot believe falsehood, and all that a moral person imagines to be true is true. Therefore, to become moral is to have potentially infinite true information at one's disposal and to be able to generate it at will.

Intelligence is the interaction of at least eight distinct, necessary components. These are Sensors (S), Connectors (N), Memory (M), Logic (L), Will (W), Imagination (G), Effectors (R), and Information (F). We may express a person's Intelligence (I) as a direct interaction of these components:

EQUATION 2: $I = S * N * M * L * W * G * R * F$

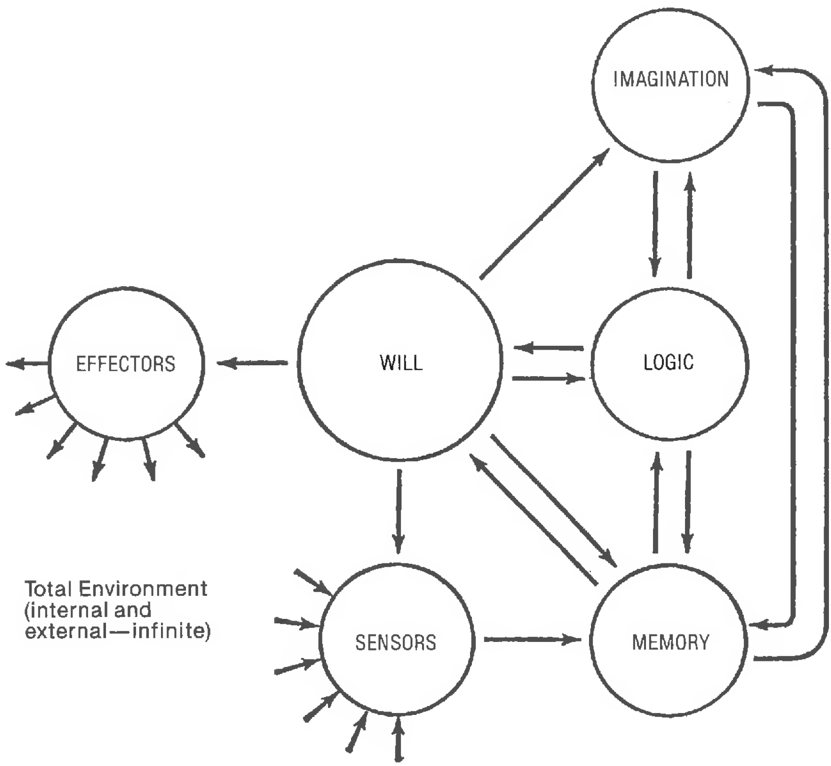
The simplest direct interaction would be:

EQUATION 3: $I = S \bullet N \bullet M \bullet L \bullet W \bullet G \bullet R \bullet F$

Where: $*$ defines any general direct interaction, e.g. multiplication

$\bullet$ defines any simple scalar product, e.g. simple multiplication

The Components of Intelligence



Flow of Information along Connectors between the environment and the components of intelligence under ordinary conditions. Under extraordinary conditions (e.g., neurosurgery), it is possible for the environment to affect any or all the components of intelligence directly.

Creativity is the highest form of intelligence which results from adding a new component, Ethics (E), to the interaction as in Equation 1. Preethical beings have zero creativity, although they have all the other components of intelligence. The creation of creativity is "morality," the highest form of creativity.

If any component in a direct interaction goes to zero, then the resultant also goes to zero. Similarly, if any component in a direct interaction goes to infinity, then the resultant also goes to infinity. Therefore, if either Imagination (G) or Information (F) goes to infinity, then Intelligence (I) goes to infinity. If Imagination (G) is infallible, then it is equivalent to having infinite Information (F) at one's disposal.

Definition 24: Imagination (G) is the ability and the act of generating new Information (F) independently of the Sensors (S).

It will be shown that human, not animal, Imagination (G) *always* generates true Information (F) independently of the Sensors (S), but that truth whether it comes from the Sensors (S) or the Imagination (G) is distorted and falsified when we value happiness more than truth. When we are unethical we Will (W) our Logic (L) to distort truth into falsehood in order not to have to give up a cherished paradigm. If we behave unethically, we believe what makes us happiest, although false. The more ethical we become the more we trust our human Imagination (G) and the less prone we are to believe falsehood.

All intelligent beings have some degree of Imagination (G) by which they generate new Information (F) when the Information (F) in their Memory (M) represents the existence of mutually exclusive events. Recall from Definition 1 that Information (F) is the symbolic representation of events and their relationships. When our Logic (L) tells us that two events exist, and they are mutually exclusive, then we know that some of our Information (F) about reality is either wrong or incomplete. Our Will (W) directs our Intelligence (I) to generate new Information (F) that will make all the Information (F) in our Memory (M) coherent and noncontradictory. New Information (F) can be generated indirectly by the Effectors (R) through objective experimentation whose results are reported by the Sensors (S) through the Connectors (N) to the Memory (M), or directly through the Imagination (G). In any case, it takes Imagination (G) to design any experiment that will give us new true Information (F). (Recall Definitions 2 and 3 of truth and falsehood.) Therefore, we cannot effectively increase truth for ourselves without some use of Imagination (G). Also, no human being is devoid of Imagination (G). Since when $E = 1$, and a person is moral, then the person cannot imagine anything false and the person can always resolve all apparent contradictions correctly through the use of Imagination (G), either directly or indirectly; this is equivalent to having infinite Information (F) at our disposal.

All the components of Intelligence interact with each other according

to the related diagram and Equations. When Ethics (E) are added to the interaction, they give direction and resolve to the Will (W) and derandomize the Imagination (G) so that the Information (F) we imagine is true and available on demand. The same process that increases the veracity of our Imagination (G) also increases its productivity. So that we imagine more, more accurately as we increase our Ethics (E) until Imagination (G) is essentially infinite when we are fully human and become moral ($E = 1$). At the same time the Will (W), a vector quantity, becomes oriented more and more in the ethical direction of maximizing creativity and is less concerned with increasing happiness. That is why intelligence is not always independent of Ethics (E) and Corollaries 1.10 and 1.11 hold true. But intelligence is independent of ethics up to the point of being human. Because $C = IE$ (from Equation 1), the person's creative potential is infinite when $E = 1$. **End of Explanation 1**

The main purpose of this book is to teach those who value creativity more than happiness a practical technique for producing this infinite potential for creativity through morality in themselves and those they love.

Why, then, is it so difficult for human beings to become moral? The answer is twofold. First, we cannot become moral by ourselves, but only by helping another person become moral. Second, through individual fear all human organizations become destructive to the evolutionary process. Human evolution cannot continue unless we can learn how to conquer fear. These two phenomena represent an extrapolation of a pattern that exists throughout all evolutionary history.

Evolution

A common denominator in the evolutionary process is a constant increase in the collective intelligence of the biosphere. In general the metazoa are more intelligent than the protozoa, the vertebrates are more intelligent than the invertebrates, the amphibians are more intelligent than the fish, the reptiles are more intelligent than the amphibians, the mammals are more intelligent than the reptiles, *Homo sapiens* is more intelligent than all other mammals. Furthermore, this is the order in which the fossil record indicates the biosphere has evolved. Therefore, increasing intelligence "through the unfolding of the implicate order," as David Bohm might say, is a common denominator in the evolution of the biosphere [62, 63].

Intelligence itself grows in both quality and quantity. The lowest level of intelligence is no intelligence at all, as is represented by absolute entropy (the nonavailability of energy for doing useful work) or total chaos. Total chaos or absolute entropy can predict and control nothing. Matter or coherent energy represents the next level of evolution. Matter can predict and control its own integrity of form. Matter is a homeostatic system which

resists change and often reasserts a previous form when disrupted. For example, in a suitable environment an atom will complete its normal complement of electrons if electrons are stripped from its outer shells. However, the behavior of matter is completely deterministic in its higher forms. Matter has no element of choice in its intelligence. Although individual quantum events are not precisely predictable, that seems due, as Einstein believed, to their connection to hidden variables, not to choice. True choice begins with life and evolves along with intelligence and ethics. Infinite choice comes only with infinite intelligence. But infinite intelligence cannot exist without morality. This is part of the moral order of the universe which limits the power of evil. The power of evil causes its own destruction at a human level of intelligence. The only evil that exists comes from our own fear, as will be shown later.

Life predicts and controls its own integrity of form just as matter does, but it can also predict and control things outside of its own form. Life can reproduce, metabolize, and mutate, which is to evince a higher order of intelligence than occurs in matter. Above all, life can choose to innovate. It can choose to do something that has never been done before and pass on this ability to its progeny. I postulate the following:

All atoms of a given species (elements) behave exactly the same forever. They never choose or innovate anything. Even a single, simple cell can choose to do something new that has never been done by any other cell. When it innovates, the cell generalizes and evolves. When it chooses to keep repeating the same pattern of behavior over and over again, it specializes and eventually brings about its own extinction. The choice to innovate is the source of almost all benign mutations which generalize the species, but may also produce deleterious mutations. The refusal to innovate, that is, the choice to continue repeating the same behavior, is the source of all mutations which lead to ever increasing specialization. The totally non-Lamarckian quantum mechanism by which this occurs is discussed later. Random mutations not involving choice, but due to vagaries of the environment, such as chemicals, radiation, or heat, are almost always deleterious; their cumulative benefit or true information content has measure zero, contrary to neo-Darwinism, which says that all benign mutations are random and consequently do not have measure zero.

A specialist does increasingly more of the same thing until it entirely ceases to innovate and can only repeat a pre-established pattern of behavior common to all members of its species. A specialist always becomes a total conformist within its speciality. A generalist generalizes by adding bits of information to its knowledge base about what it knows least; it is constantly innovating behavior so that its repertoire of behavior is constantly expanding until it can innovate in a maximum number of areas within the constraints of its species. When it exceeds those constraints it becomes a member of a new species that can continue to evolve. The generalist evolves

by knowing more and more about more and more until at infinity it knows everything about everything. The generalist evolves forever. The specialist always adds bits of information to its knowledge base about what it knows most while increasingly ignoring what it knows least. It knows more and more about less and less until it knows everything about nothing. It then stops evolving and eventually becomes extinct. The choice not to innovate causes a species to specialize and mutate into ever more specialized, ever less intelligent species. The choice to innovate causes a species to generalize and become more intelligent. Specialization leads to short-term success at the cost of long-term danger. Generalization does the opposite. In an infinite game the best long-term strategy always wins. That is why all specialized species are extinct or destined for eventual extinction.

Definition 25: A *Generalist* has maximum truth about a maximum number of aspects of the environment. Generalization leads to a maximization of intelligence, a long-term advantage.

Definition 26: A *Specialist* has maximum truth about a minimum number of aspects of the environment. A specialist is distinguished from a generalist not by what it knows but by what it does not know. Specialization leads to a minimization of intelligence. Even if some particular specialized type of intelligence is increased at the beginning—a short-term advantage—overall intelligence is decreased by specialization—a longterm disadvantage.

Therefore we can see the basic pattern of evolution. It is in harmony with the moral order of the universe. The direction of evolution is toward ever greater generalized intelligence that results from the choice to innovate. The most generalized form of intelligence is the ability to create. Matter has intelligence solely about its own integrity of form, but it cannot innovate. Life has intelligence about its total environment—physical, biological, and psychosocial; it can innovate. Humans have intelligence about intelligence. They can predict and control their own ability to predict and control. We call this new dimension in intelligence "Ethics" (E). When E interacts with the other components of intelligence that we share to some degree with all other animals and even plants, then we become capable not only of innovation but of creation.

To innovate means to generate new information independently of the sensors. But it is just as likely to be false information as it is to be true, so long as it is a product of our animal imagination. To create means to innovate more that is true than is false. Recall the implications of $E > 0$ from Equation 1. For almost all subhumans, except possibly for some of our closest generalized mammalian cousins, $E = 0$ (it does not exist). For pre-hominid species true innovations are positively selected while false innovations are eliminated by natural selection. Almost all pre-hominid species are neither systematically creative nor destructive. Hominids can be systematically destructive as well as systematically creative. As we become

fully human then our Ethics (E) goes to one (1). A corollary is that we are the only living species that can choose suicide. We are our own major source of natural selection. Evil ($E < 0$) always destroys itself, although it can also destroy some things that are good along with itself.

Definition 27: The next step in the evolution of intelligence is *morality*, or $E = 1$. When morality occurs we are fully human and have intelligence about our own ethics: we can predict and control our own ability to predict and control our own ability to predict and control. When we are moral we can create creativity systematically without ever destroying. A species that has reached that level of evolution I call a *Moral Society.*

The pattern of evolution is that the biosphere moves toward the Moral Society not smoothly or regularly, but by giant hierarchical quantum leaps—leaps of four complementary pairs of evolutionary units from the previous hierarchy, taking us to the next hierarchy. This is the pattern of evolution as I see it:

An atom of hydrogen is a complementary pair comprising one electron and one proton. Hydrogen is the simplest, least intelligent atom that exists, i.e., it predicts and controls the integrity of form of the simplest of all atomic structures. The first quantum leap in atomic evolution is from hydrogen to helium by *the fusion of four hydrogen atoms, i.e., four complementary pairs of electrons and protons.* The fusion of helium leads to the carbon atom, which is the most chemically generalized of all the atoms because it is the only atom that is both an electron donor and an electron receiver, equally, *for all four valence electrons and all four valence protons.* This is the most generalized of the basic chemical properties of atoms.

Chemical evolution is a more generalized way of producing greater intelligence than nuclear fusion, which leads to unstable deadends with atomic weights in the hundreds for the transuranium elements. Organic molecules evolve to have atomic weights of several million, a much greater complexity of form than the largest atoms. Furthermore, *the carbon atom is the only atom which in itself consists of four fully generalized complementary pairs of active electrons and protons,* the other electrons and protons being neutralized in an inner helium atom and four neutrons. (Neutrons may be seen as a fusion of electrons and protons.) This leaves the carbon atom as the first and only fully generalized atom consisting of four active complementary pairs of protons and electrons. The carbon atom is, of course, the basis for the evolution of matter into life. Carbon enables the first giant quantum leap in the evolution of matter whereby an entire new dimension is added to the intelligence of matter, and new properties such as imagination, choice, and innovation manifest themselves.

Definition 28: We call such a giant quantum leap in evolution a *full dimensional quadrature.* Minor quantum leaps are called *dimensional subquadratures.*

There are, as far as we know, at least five full dimensional quadra-

tures in the history of the evolution of our local universe. The first is the cosmic singularity by which our local universe came into being in an infinite sea of entropy. (This does not preclude an infinite number of other non-local universes outside of our time and space.) All the matter and energy in our local universe apparently came into being at that instant, although not in its present form. Further evolution required the organization of matter into ever more complex and more intelligent forms. Intelligence and complexity are correlated but are not synonymous. An intuitive but incomplete measure of complexity is the number of components in the system multiplied by the number of coherent connections between all the components, multiplied by the number of differences between all components and all connections, multiplied by the total bits of information shared by all the components of the system.

The next full dimensional quadrature is the creation of life out of matter, although by dimensional subquadratures before life began there was an enormous amount of evolution of matter into all the diverse atoms and molecules.

Definition 29: The beginning of life involves a special type of chemical interaction called *autopoiesis*, which is a term coined by Varela and Maturana [796] to describe the process by which DNA creates protein while protein creates DNA within a living cell. Neither can create itself by itself, but together both can create one another. I now use "autopoiesis" in a more general sense than Varela and Maturana did to mean "a creative exchange of complementary information."

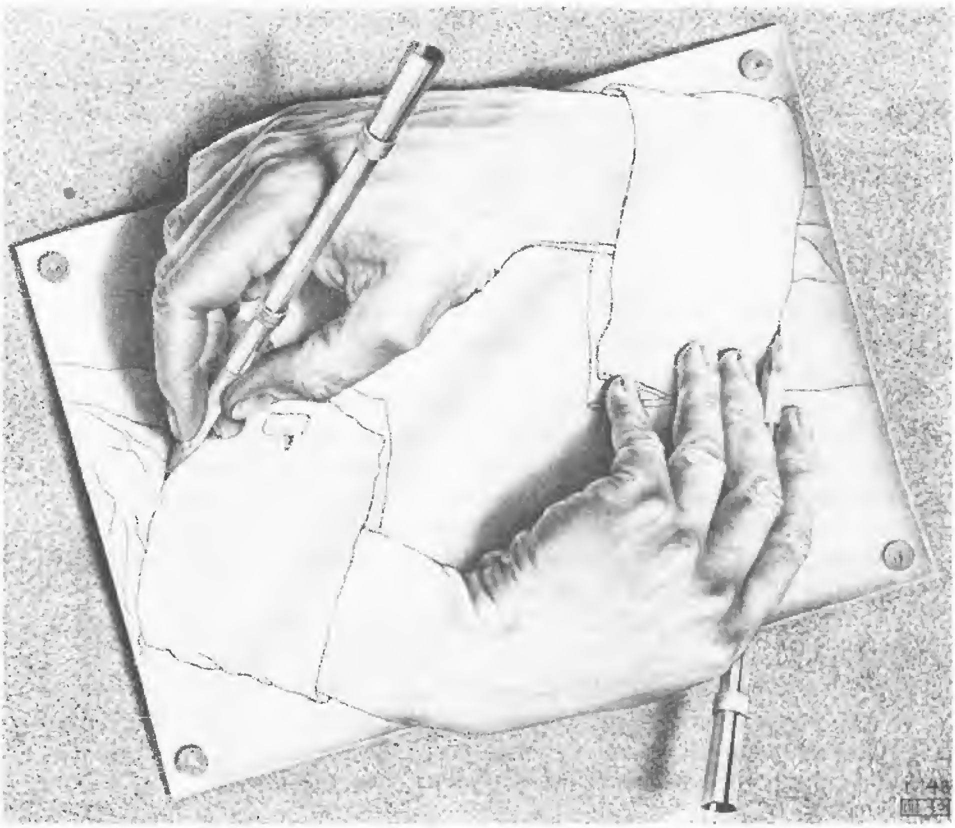
The point at which autopoiesis began between DNA and protein is the best estimate of when the transition from matter to life occurred.

A good artistic visual expression of autopoiesis is Escher's "Drawing Hands," reproduced on the following page. The two complementary hands can draw each other, but one hand cannot draw itself. A good artistic musical expression of autopoiesis and evolution in general is J.S. Bach's *Art of the Fugue* (for reasons which are given later).

What makes autopoiesis possible is the existence of four complementary pairs of self-reproducing molecules. They are adenine, cytosine, thymine and guanine, and they make up the DNA molecule, which is itself a complementary pair. (Thymine is slightly altered into uracil in T-RNA when information is transferred from DNA to a ribosome to make a protein.)

I postulate that the first living cell in autopoiesis was a chemical system made of four complementary pairs of DNA and protein molecules. It took approximately from 500 million to one billion years to evolve from simple organic molecules formed about 4.6 billion years ago during the creation of earth. These early simple cells were replaced through natural selection by more intelligent, more generalized cells.

I postulate that the first metazoa were made up of four complementary pairs of autopoietic cells. This was the third major dimensional quad-



Drawing Hands by M.C. Escher. An artistic representation of the process of Autopoiesis. The left hand draws the right hand and the right hand draws the left hand. From two dimensions emerge three dimensions through a "creative exchange of complementary information" (Autopoiesis). Escher image copyright © 1989 M.C. Escher Heirs / Cordon Art - Baarn - Holland.

rature in evolution. These simple metazoa, which no longer exist, were replaced by more complex metazoa such as volvox and the sponges. It took the metazoa about three billion years to evolve from the first cells.

The fourth major dimensional quadrature in metazoan evolution consisted of the beginning of nerve systems. I postulate that the earliest nerve nets—they no longer exist—consisted of four complementary pairs of autopoietic neurons. An example of simple nerve nets that survive are those of the hydra, which is a much more complex life form than that which had the simplest nerve net. The first nerve nets took about 500 million years to evolve among the first metazoa. Nerve nets are subsystems of all higher brains. The brain evolves by adding newer structures without throwing away any of the older structures. These additions were dimensional subquadratures, up to the creation of the human brain, which was a full quadrature.

The early nerve nets eventually evolved into a supersystem of four complementary pairs of autopoietic nerve systems, the human brain. The first and most complex early nerve nets evolved into the fish nervous system, the highest level of autopoietic complexity reached by the basic nerve net model. The fish brain took about 400 million years to evolve from the first nerve nets. The next system to evolve was the reptilian brain, or R-complex, which is a distinct brain superimposed on the original fish brain, and in autopoietic interaction with it. The full R-complex took about 300 million years to evolve from the fish brain. The next system to evolve was the mammalian brain, or the mammalian cortex (includes limbic system), which is a distinct brain superimposed on the original fish and reptile brains and is in autopoietic interaction with both systems. The mammalian brain took about 200 million years to evolve from the R-complex. The last brain to evolve was the neocortex, which is a distinct brain superimposed on the previous three brains and is in autopoietic interaction with them. The neocortex became fully evolved only about 100,000 years ago and took about 100 million years to evolve from mammalian brains with little or no neocortex.

The neocortex could specialize or generalize. Cetaceans, elephants, and all extinct hominids specialized it. Humans generalized the neocortex by ethical choice, thereby fully developing the frontal lobes. The frontal lobes are directly reponsible for human creativity. Creativity is the most generalized form of intelligence, resulting from adding the ethical component.

Each cerebral hemisphere is a complement to the other—the now well-known right brain/left brain duality. (The four complementary, paired, autopoietic brains making up the human nervous system are the fifth full dimensional quadrature.) As the first fully autopoietic set of four complementary, paired brains, the human brain produced a new epiphenomenon: we have called this Ethics. Ethics, in turn, interacted autopoietically with the other eight complementary components of classical intelligence. As will

be shown in some detail and as was first postulated by Professor Amit Goswami of the Physics Department at the University of Oregon [299], the human brain has both classical and quantum modalities of operation. This in turn was derived from a postulate of physicist Henry Stapp, of the University of California at Berkeley, who postulated quantum mechanisms in the human brain [738]. I postulate the following:

Definition 30: The *classical brain* is made up of the lower three brains and part of the neocortex. It is capable of learning and repeating complex patterns of behavior. It usually learns by classical conditioning, although it can also learn through the quantum brain. The classical brain is receptive to the quantum implicate order when it engages in trial-and-error behavior that is just as likely to make errors as to produce new truth. However, a fifty-percent chance of success is much better than the success rate of totally random mutations.

Definition 31: The *quantum brain* is made up of the frontal lobes and possibly other parts of the neocortex. It is capable of always generating original, true information independently of the sensors. The quantum brain is inhibited by conditioning; it learns solely by ethical choice by modulating infinite true information from the implicate order of quantum reality [63].

The classical brain produces the classical modality. The quantum brain produces the quantum modality. The classical modality enables us to learn complex patterns of behavior and to repeat them. The more classically intelligent a creature, the more complex the patterns of behavior it can learn and repeat. The classical modality of the human brain depends on the first three brains and part of the neocortex.

The quantum modality enables us to generate new ideas and to have original thoughts on any subject *which are always true.* This modality seems tied to the frontal lobes of the neocortex, but it may also involve other parts of the neocortex. This is the "human" part of our brain. It is clearly destroyed when the frontal lobes are destroyed [793]. A random generator of true information is a remarkable entity which cannot be explained classically; a holistic quantum mechanical model of reality is required to explain it. This is a model that we will develop in this book.

Our classical brain enables us to behave intelligently, succeed in school, hold down a job, and do well on I.Q. tests, but it cannot generate a single original idea. It can, however, induce us to engage in simple trial-and-error behavior which through natural selection can lead to the consolidation of true innovations, as is the case with all lower animals.

The quantum modality can generate abundant, new, true ideas, but these ideas cannot express themselves in any way except through the intelligence of the classical brain. Therefore, human beings can only be creative through autopoietic harmony between the classical and the quantum brains. That is the nature of the interaction of our quantum Ethics (E) with

our classical Intelligence (I). The classical and quantum brains are a new complementary pair that is responsible for all human creativity and the unique nature of human evolution through the creative accumulation of extragenetic information within our species.

We note that a new, true idea and a new, beneficial mutation are analogous creative events and are caused by the same underlying mechanism—a quantum (nonlocal) field of infinite, enfolded truth, outside of our time and space. This is David Bohm's "implicate order." It is the higher source of truth and moral order assumed by the mystical paradigm. This notion is very similar to Jung's mystical model of the collective unconscious. This is the source of Einstein's "hidden variables." True and false information comes to us randomly from the choice to innovate. Absolutely true (nonrandom) information comes to us from the deliberate choice to behave ethically. Therefore, there is a mystical-moral basis to both evolution and individual creativity. Evolution is a creative process by which true genetic information is consolidated in the biosphere and false genetic information is eliminated—all by natural selection. All creativity requires an interaction between the objective, natural universe and the mystical, quantum universe, i.e., creativity is produced by autopoiesis between classical and quantum modalities. The Chinese mystics called this the interaction between the *Yin* and the *Yang*.

Although almost all children seem to be creative, few adults seem to remain creative. Furthermore, all civilizations up to the present have systematically destroyed their own creativity. The reason for this paradox is *fear*.

Fear

Fear is hard-wired into the reptilian complex. Fear is an instinctive, genetically preprogrammed, neurophysiologically determined response to danger. When we are frightened, the reptilian brain takes over our consciousness and compels us to fight or flee based on all the classical information at hand. The reptilian brain evolved over a period of three hundred million years in a purely classical context, where danger was constantly faced and in which our ancestors had to respond rapidly and accurately if they were to survive. They had no creativity on which they could depend. The only reasoning involved was in determining whether one was more likely to survive fighting or fleeing. Within this context, fear, anger, and hatred are basically the same emotion. All danger triggers fear in the R-complex. If the danger has any chance of being fought successfully, fear becomes anger. If the danger is long-enduring and cannot be fought, fear becomes hatred, which again expresses itself as anger if the danger ever can be fought. Fear induces the repetition of previously successful behavior which enabled us to survive in the past. Fear inhibits innovative behavior which

may lead to new advantages over the old behavior, but may also induce new danger.

Human society is subtle and symbolic in the ways that its dangers are manifested and responded to. Fear may result not from having one's life threatened, but from having one's paradigm—and, consequently, one's ego-identity—threatened. A common response to this type of danger is to attack the source of paradigm threat through verbal abuse, symbolically discrediting the source of information contradicting a cherished paradigm. That is what many religious fundamentalists, including Marxists, do when they attack and ridicule proponents of biological evolution. Of course, when ideologues of any persuasion have enough power, they usually have no compunctions about imprisoning or even killing those who attack their ideology. This happens today in Communist and in Islamic societies. It would happen in the United States if some of the alleged "Christian Fundamentalists," or other militant American ideologues who wish to impose their views on others, had all the power they wanted. Some scientific specialists behave similarly to the religious fundamentalists by attacking any approach to truth outside the scientific paradigm as "superstition." These scientists, as fear-ridden as the religious fundamentalists, have brought about a *New Inquisition,* as in R. Anton Wilson's book.

Another, more common, response to a threat to one's paradigms is to flee into protective ignorance by ignoring and refusing to learn any information which might contradict those paradigms. This is typically how most Americans respond to evidence indicating that the American Democracy may have become degenerate, and that the United States is in fact an oligarchy in rapid decline, ruled by the most evil and least creative persons its society can produce. These rulers obtain and maintain their power through lies and by manipulating the fears and protective ignorance of a majority of the electorate. Those who retreat into protective ignorance use as a partial solace the fact that almost every other country is worse off, thereby avoiding the difficult and risky actions necessary to protect their future welfare and that of their progeny. Protective ignorance increases happiness but decreases creativity. It is an unethical response to danger analogous to hiding one's head in the sand. It is produced when the R-complex dominates us.

In modern society the hard-wired fear response of the reptilian brain has become a firm belief that one cannot create. I will do my best to eliminate that destructive belief by creating a new paradigm that shows that every human being can create if and only if he or she chooses to be ethical and become moral, even if this choice is unconscious.

Definition 32: *Fear* is the belief that we cannot create.

When this belief is combined with a low level of ethics, fear is transformed into a system for warping the imagination into producing self-delusion by distorting truth into falsehood. Just as the quantum brain is a

mechanism for producing true information, fear, when it becomes transformed into the belief that we cannot create, becomes a mechanism for distorting all truth into self-delusion, regardless of whether the truth has come from our quantum brain or from our sensors. This is what makes fearful persons so easy to manipulate through comforting lies that help maintain their illusionary paradigms. The degree to which we distort reality is proportional to our fear, i.e., to how firmly we have come to believe consciously or unconsciously that we cannot create.

Fear is turned into the belief that we cannot create because every human society, no matter how ethical or noble its original structure, has always been turned into a bureaucracy.

Definition 33: A *bureaucracy* is an organization with a built-in mechanism for destroying negative feedback.

Definition 34: *Feedback* is the perception of consequences of our actions.

Definition 35: *Positive feedback* is the perception of our successes; it makes all recipients happy.

Definition 36: *Negative feedback* is the perception of our failures. Negative feedback frightens persons who have no confidence in their creativity. Only persons who are highly ethical are made happy by negative feedback, because it maximizes their creativity; all others are made unhappy by negative feedback.

Note: It is not possible to create if one fears failure.

Definition 37: An *organization* is any association of two or more persons with at least one common goal and with at least one commonly accepted rule of behavior.

Most organizations have many goals and even more commonly accepted rules of behavior. If any persons in that organization are driven by fear and are convinced that they cannot create, then they will believe that the only source of security for themselves is to avoid negative feedback by controlling other persons. Because they cannot provide for themselves what they need, they must live parasitically off others. Persons driven by fear are by definition persons who do not believe that they have the creativity to provide for their own needs. Therefore, they must take from others what they need for themselves. The greatest threat to fearful persons are creative persons who do not need the fearful persons and can see them for what they are. The seemingly safest course for fearful persons is to control other persons as completely as possible and to convince them that they are also uncreative. As in the case with many other parasites, human parasites often destroy their hosts. Human beings become parasites only out of fear.

Definition 38: An alternative definition of "bureaucracy" is an organization with a built-in mechanism for convincing its members that they are uncreative and can only live parasitically off the creativity of others. The two definitions are functionally equivalent.

What creative persons most value is being creative. What they least value is having power over others. Since they are ethical, power over others is seen as a burden which interferes with their creativity. They only want power over themselves. What fearful persons value most is having power over others. Therefore, it is an inevitable dynamic in all human societies up to now that the most creative persons neither seek nor want power within the society. They merely wish to be unimpeded in their creativity. The only persons who seek and want power over others are those who are driven by fear. Therefore, in all human societies up to the present time, no matter how progressive or enlightened the original leadership, the most fearful, least creative persons eventually end up with almost all of the executive, legislative, judicial, and economic power, even though all power and wealth grow out of human creativity. How many presidential candidates, congressional representatives, senators, judges, or multimillionaires have ever discovered a scientific law, invented a machine, produced a work of art, or been in any way objectively creative? In the last fifty years, very few. The percentage is rapidly going to zero as our society becomes a total bureaucracy with irreversible entropy. We note that during the founding of the United States, when there was much less bureaucracy, many of the leadership were creative, e.g., Jefferson, Franklin, Hamilton, Madison, the Adamses, and Washington. The reason we could produce so many creative leaders with a population of 3.5 million but can no longer produce even one comparable leader with a population of 250 million is not genetic decay, but bureaucracy.

Creative persons tacitly support the parasitical leaders so long as they are given enough opportunities to be creative. When these opportunities are eventually and inevitably all taken away by an all-pervasive, all-consuming bureaucracy, the creative persons in the society revolt and overthrow the leadership if there are enough of them left, and if they still have the will and vision to revolt. This happened in the American, French, and Russian Revolutions, and under more peaceful conditions in other European countries as they were turned into social democracies. More often than not, the fearful leaders of the society have, by this time, been able to pervert all the social institutions to convince the entire population that it is also uncreative, making it easier to control. Nothing makes a person easier to control than fear. The absence of fear and full confidence in one's own creativity makes a person uncontrollable. Such persons can only be induced to cooperate by showing them that they can be more creative in a cooperative organization than by themselves. In the past, all such organizations have eventually been taken over by the least creative, most fearful persons. That is why creative persons have a tendency to be loners and not trust organizations. This, in turn, makes all human organizations even more vulnerable to parasitical control. The worst such organizations are tyrannies which are totally devoid of creativity. These exist throughout the

world, not solely in Africa, Asia, and Latin America. We engender such tyrannies through collective fear by giving bureaucracies power over individual creativity, so that eventually no person can create without the permission of destructive bureaucracies. It takes only a majority of the adult population to be fear-driven to destroy any nation, no matter how democratic. Two corollaries of these considerations follow.

<u>Corollary 1.12</u>: Any organization that wishes to evolve must deny power over the organization to anyone who seeks it.

<u>Corollary 1.13</u>: The only way to keep organizations creatively evolving is to assure that (a) power by persons over other persons in the organization is minimal, (b) no one in the organization has the power to inhibit anyone else's creativity within the organization, and (c) all delegation of power is done by unanimous consensus for the sole purpose of maximizing the creativity of all members of the organization without diminishing it for any given member. It is better to have no organization at all than ever to diminish a single person's creativity, no matter how many other persons are allegedly benefited by the organization, because unethical means cannot achieve ethical ends. To assure that organizations remain creative, it is essential to keep them small; they grow by spinning off new small organizations in free association with the parent.

The central problem facing humanity is how creative persons can amplify their creativity in organizations that do not degenerate into bureaucracies. The greatest impediment to solving the problem is that institutions from our schools to our political parties are dominated by fear-driven bureaucrats who constantly punish creative, unpredictable behavior while rewarding repetitive, predictable behavior in such a way that almost all adults become convinced that they are uncreative; they become conditioned to be totally uninterested in creativity and to value only being happy. Fear induces ethical vampirism, turning each host into a new parasite who in turn transforms still more hosts into still more parasites, until entropy is irreversible.

Almost from birth to the end of their days, in every nation on earth, human beings are promised punishment if they are creative. But throughout life they are promised happiness if they (1) do not think for themselves, (2) believe whatever everyone else believes, (3) repeat the conditioned behavior they have been taught, and (4) are pliant and cooperative with the bureaucracies that are destroying them and their progeny. If they cooperate with the bureaucracy, they will have money, prestige, and a sense of belonging to the larger society. If they refuse to cooperate, they are constantly punished. This produces a fearful population devoid of ethics and devoid of creativity.

This conditioning eventually destroys the creativity of any nation no matter how initially progressive, even if it takes thousands of years as in the cases of Ancient Sumer and Egypt—or if it takes only 200 years as in the

case of the United States, or 70 years as in the case of the Soviet Union. Evolution is an exponentially accelerating, impersonal process. Creation and destruction, evolution and entropy, are complementary pairs forming a self-catalyzing system.

The root of the problem is fear. The only antidote to fear is love.

Love

Love is our most personal and meaningful experience. We all search and long for love, although it is not always clear what we mean by "love." We speak of loving our parents, our children, our mate or hoped-for mate, and even of loving food or art. We clearly mean different things by "love" in these different contexts. Love is not synonymous with the strong desire for something. If it were, there would be no difference between saying that an addict loves heroin and that we love our children. When we love someone we may have a strong desire to be near him or her. But this desire is not the same as the love which contributes to the desire. Desire and possessiveness in general are not love. Love is something we give, not something we take. To be clear and unambiguous, we shall use the word "love" only to mean the desire to enhance, together with the act of enhancing, the creativity of another unconditionally. This is the common denominator in the word when we say we love our parents, our children, our mates, and our friends.

Definition 39: *Love* is the desire to increase and the act of increasing the creativity of another unconditionally, without selfish considerations.

Love is a cause and an effect of creativity. We are benefited far more by the love we give than by the love we receive. Nothing we ever do will increase our creativity more than seeking to help others, including our enemies, to maximize their own creativity. Increasing the creativity of anyone benefits everyone. That is why we should love our enemies. That is why we should love our neighbor as ourselves. That is what it means to return good for evil. However, if we are never loved we become incapable of giving or receiving love. Few things damage a child as much as being unloved by all around him or her. We are all usually loved by at least one person, e.g., by a parent, and that is usually enough to prevent irreversible damage.

Theorem 2

It is not the love we receive but the love we give that ultimately leads us to the total conquest of fear and allows us to become moral and, potentially, infinitely creative.

Explanation 2

Ethics are rules for maximizing objective truth. Ethics are rules for optimizing evolution. Ethics are an expression of our desire for truth. Creativ-

ity is our ability to expand objective truth. Love is our desire to expand the creativity of another. Love is the highest form of creativity. It is the creation of creativity. Fear is the belief that we cannot create. Love and fear are the only human emotions that exist. All other emotions are interactions of these two primary emotions. When we are fully ethical, i.e., moral, we only feel love. When we believe that we cannot love someone, or that someone is decreasing truth, we feel anger. Anger is the conscious manifestation of our unconscious fear of having our creativity diminished. Anger is the unconscious belief that we cannot love creatively. All fear is an illusion. Like all illusions, fear serves only to diminish objective truth. The only antidote to fear is love. If we have never loved we cannot overcome our own fear. Persons behave unethically only when they are driven by fear. The more unethical they become, the more they are driven by fear. The last fear we overcome is our belief that we cannot love creatively.

To love creatively means that we can help others overcome their fears and become more creative. The lowest form of love is the love we give in return for the love we receive. The highest form of love occurs when we love the enemies who hate us and decrease truth for ourselves and others. An enemy is any destructive person. If we cannot love our enemies and thereby help them overcome their fear and be creative, we cannot ourselves become moral.

To love our enemies does not mean that we tolerate destructiveness. When we love someone we must give negative feedback when they are destroying; otherwise our love is perverse. The creative challenge is to give negative feedback with love and not with anger. This is the most difficult thing we will ever learn. When we give negative feedback in anger, we merely project our fear (i.e., our belief in our own inability to create) into another and thereby make that person potentially more fearful and unethical. Only highly ethical persons are capable of responding to anger with love. We must treat everyone as if they were ethical and therefore love them, because it is unethical to be certain. Our logic may tell us that unethical persons have irreversible entropy and cannot be made creative. Still, we must love them or we will never overcome our own fear of being unethical, i.e., uncreative.

We must love our enemies because we can never be certain that anyone is unethical. Human beings are far too complex for any other human being to understand completely. To judge an ethical person as unethical is extremely destructive to us and to that person. Therefore, the optimal strategy is to treat all persons as if they were ethical and not to judge them. If they are in fact ethical, they will respond positively to our love. If they are unethical, they will merely be driven away by love and threaten us less than if we had been unloving. Still, we must not judge those we drive away as unethical, but instead consider that we may be in error in how we treated them. We may not know yet how to love properly. So long as we are not

moral, we will not be able to love properly, although so long as we behave ethically our love will be adequate for dealing with other persons who also behave ethically. The real challenge is in loving persons who behave unethically. These are our enemies.

We must love our enemies to be sure we do not deny love to our friends. We cannot become moral by ourselves but only by helping another person become moral. This is what "autopoiesis" means at the human level.

The Moral Society can only be created through love. We can only learn to love creatively by teaching creative love to another. We must begin by teaching creative love to one other person. In the process we will learn creative love. Once we have done this, the other person becomes our complement in a complementary pair. Complementary pairs create one another by giving highest priority to increasing one another's creativity. If we cannot love at least one other person as ourselves, we can never hope to love our neighbor as ourselves. Therefore, we begin by making a commitment of love to one other person, but we cannot stop there.

The mutual creation of ourselves with our complements will help us overcome many of our fears but not necessarily all of them. We may still believe that we cannot creatively love persons other than our complements. This will produce fear and even destructive behavior. Perhaps we may only have one complement at a time. Perhaps we may fear that we can only form another complement by destroying the bonding with our last complement. Persons who try to have several complements at a time may seem to always fail. Therefore, we should at first concentrate on creating ourselves in a single complementary pair at a time with the only kind of person who can be our complement: that is, an ethical person of the opposite sex. However, the relationship itself need not be sexual. Then we can go on to the next step in our personal evolution, which involves loving persons who are not our complement or our children, since our children are part of us and possibly of our complementary pair. Remember that when we speak of "love" we mean an ethical, not a sexual, process.

As was indicated earlier, it appears that nature evolves by organizing complementary pairs into systems of four complementary pairs. Our ethical intelligence is the product of four paired complementary brains: (1) the neocortex, (2) the mammalian cortex, (3) the reptilian brain, and (4) the fish brain, i.e., the rest of the nervous system. Each cerebral hemisphere is a complement to the other. Each creative brain is the product of four paired complementary noncreative brains. The female brain is a complement to the male brain. As many recent studies have shown, the complementary differences in the brains of the two sexes are even greater than the complementary differences in the rest of their bodies [877-904].

Once we have formed a complementary pair with a person of the opposite sex, we can then form an embryonic Moral Society with three

other complementary pairs of persons all of whom love each other as themselves. We may never be able to love all our neighbors as ourselves, but we can begin by loving one other person as ourselves. Then together the two of us can learn to love three other couples as ourselves, thus creating an Ethical State.

The Moral Society, therefore, begins with four men and four women who value truth more than happiness and love each other as themselves. Each person must first be a complementary pair with one other person. Complementary pairs are not necessarily spouses. They may be parent and child, brother and sister, or just close friends of the opposite sex. We may only have one complement at a time, but cyclically and sequentially we can clearly have many complements. The process works best between loving spouses; it works least among unloving strangers.

Once the initial commitment to mutual creative transformation is made, the eight persons begin to interact to make one another moral. The central problems they must solve together are how each subset of seven can help the eighth become moral and how they can jointly become more creative as a group of four pairs than they are separately. This is how an autopoietic, collective, supermetazoan moral intelligence begins—by logical extrapolation of evolution in general and autopoiesis in particular. Only our lack of love for others can impede us. This is why we are helped more by the love we give than by the love we receive. **End of Explanation 2**

Collective Intelligence

Note that all intelligence is collective. Our individual intelligence is the collective intelligence of the billions of cells that make up our body. The intelligence of our individual cells is the collective intelligence of the self-replicating molecules that make up the cell. In order for a collective intelligence to exist in the moral dimension, the sixth full dimensional quadrature, it is essential to create coherent, multiple, ethical intelligences willing to function as one. Only ethical love of the most creative kind can engender this cooperation. The following process for creating an embryonic Moral Society is only valid for four complementary pairs who love one another as themselves. The process will not work for persons whose fear will prevent them from loving and being loved by seven other persons simultaneously.

The essential prerequisites for creative transformation to which all four couples must first agree before they can succeed are:

1. Incorporating the evolutionary ethic into every facet of their lives and making all decisions accordingly, particularly regarding how they deal with each other and how they engage in autopoiesis. They always seek to maximize creativity for themselves, each other, all humanity, and the universe in general, in that order.

2. Learning to love one another and others unconditionally and ethically by doing their best to maximize one another's creativity in a spirit of complete openness and constructive feedback, particularly autopoiesis.
3. Reducing fear in themselves and in others through ethical action, love, understanding the nature of fear, rejecting fear as a motivator, and autopoiesis.
4. Engaging in autopoiesis among themselves as best they can according to the dictates of their conscience and teaching what they learn to others.

Once four complementary pairs of ethical persons know and trust each other well enough to commit to mutual Creative Transformation, they begin discussing how to bring this about collectively and for each individual. The eight should meet by themselves for at least two hours at a time at least once per month, but not more frequently than is comfortable for any pair. They must pledge to each other complete honesty in telling one another what they believe about each other and how they believe each person can be more creative in terms of objective behavior. When anyone feels anger at anyone in the group, that person should immediately announce it to the group and the group should collectively help that person overcome the fear that produced the anger. No one should fear giving or receiving negative feedback. But remember to give positive feedback too. At each meeting, each pair should embrace or otherwise express affection for every other pair when arriving and departing. When the eight have met at least once without anyone having felt anger at anyone else, then they may be ready for autopoiesis, although those who are not too fearful may find that autopoiesis can, from the beginning, accelerate the process for producing a coherent, collective, ethical intelligence that becomes a Moral Intelligence greater than the sum of its parts.

In order to achieve a collective ethical intelligence it is necessary that the initial four complementary pairs of individual intelligences have coherent ethical thoughts. Coherence in thought requires similar but complementary thinking processes about the same problem at the same time with *rapid real-time (almost simultaneous) feedback.* In other words, the four paired brains of each of the eight persons must be ethically synchronized within themselves and between themselves. We individually synchronize our four brains within ourselves by becoming increasingly ethical until all four brains are driven by the neocortex, which is where ethical needs and creativity are centered, although the neocortex by itself cannot be creative. It takes the interaction of all four complementary paired brains plus the rest of the body plus ethics to produce our individual creativity. It takes autopoiesis between our classical and our quantum modalities.

In autopoiesis, at the supermetazoan level, we try to maximize our

collective creativity by combining eight ethical intelligences into a collective whole that is more intelligent and more ethical than any individual. This is done by each subset of seven giving feedback to each of the eight persons to help him or her correct ethical errors and misinformation which decreases creativity, as well as by giving positive feedback in order to consolidate successes. The process is enhanced by synchronizing the four paired complementary brains of each person among all eight persons.

The seat of ethics, the higher brain or neocortex of the eight persons, is first synchronized by learning a common approach for making optimal ethical decisions in all aspects of our life by the practical application of evolutionary ethics. This approach is detailed in this book as well as in my previous books, particularly *Psychofraud and Ethical Therapy.* It involves making all decisions on the basis of what maximizes creativity without any other consideration except making sure we never decrease anyone's creativity.

The more primitive mammalian cortex, which is the seat of the emotion of love as well as other higher biological drives, is synchronized as the octet learns together the meaning of love in an ethical context: namely, that love means assuming responsibility for enhancing others' creativity, and that the love we give benefits us far more than the love we receive. When the eight commit to each other their best efforts to enhance one another's creativity, then the second brain is synchronized.

The third brain, or reptilian complex, as it is also known, is the seat of the emotion of fear and consequentially also of rage and anger plus the more primitive biological drives. The fear of the R-complex seems to be modulated by the limbic system of the mammalian cortex. Fear serves primarily to divide persons and is counterproductive to ethical integration. Fear can easily be manipulated to unite persons in collective destructiveness. Therefore, the ethical integration of the third brain is done (1) by modulating fear through love in the mammalian cortex, (2) by understanding the nature of fear, and (3) by rejecting fear as a motivator by means of the neocortex, as well as through direct, real-time autopoietic communication through the most primitive of the four brains.

The fourth brain, the primitive fish brain, is the seat of conditioned and innate reflexes and is basically emotionless, as is the neocortex. We can integrate this brain directly through the sense of touch.

We communicate through all our senses. One way we can have direct, rapid real-time feedback with seven other persons is through the sense of touch. Olfactory, visual, and auditory information from eight different sources at the same time often produces confusion and incoherence. Therefore, touch is one easy way to integrate eight ethical intelligences in real time. We are currently working on another technique using electromagnetic brain-wave resonance that does not require touch.

Touch is a prime but not sole modality of information exchange for

our most primitive brain which began to evolve long before our ancestors had noses, ears, or eyes. Autopoiesis, as herein described, is a process for producing ethical coherence from the bottom brain up. There are other processes which are more complex and will be described in future books.

What follows is the result of four years of trial-and-error experimentation, hopefully guided by creative imagination. It seems to work for some persons. It clearly does not work for many persons. There may be much better ways to start. I do not know them. Follow your own intuition. You are welcome to use my clearly fallible intuition, until you have a better alternative of your own.

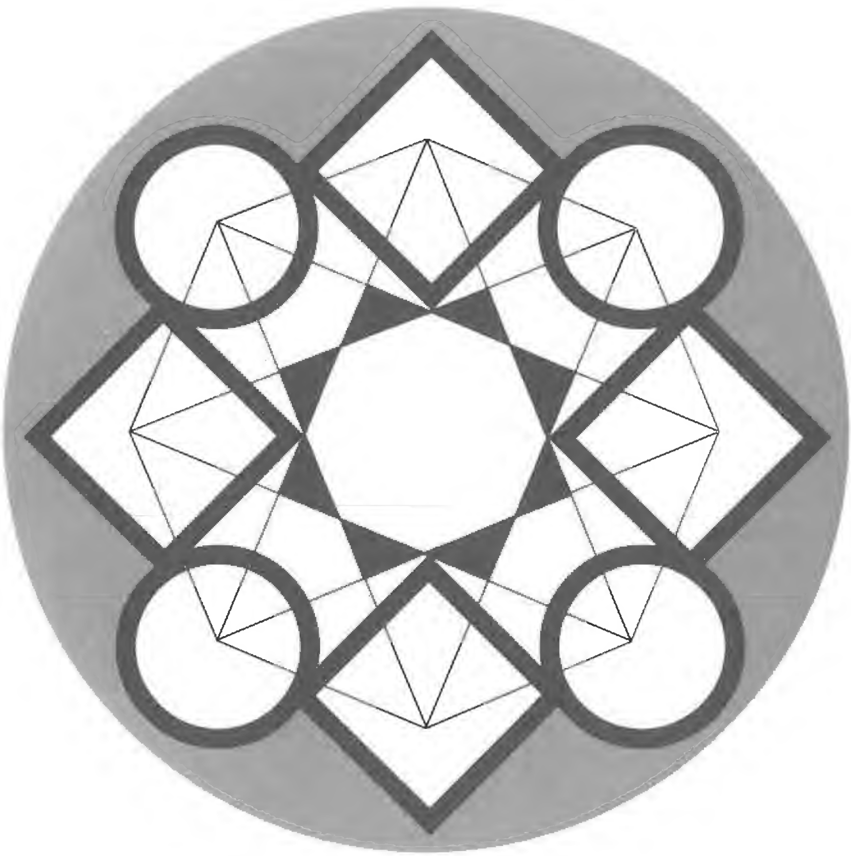
Autopoiesis

Autopoiesis seems to be produced at an elementary level, for some persons, by each person in the octet of four couples simultaneously touching four other persons of the opposite sex. There are several ways of accomplishing this task. The most practical from the point of view of comfort and minimal resources required is as follows: The four complementary pairs arrange themselves in a compact seated circle facing inward. All eight have bare feet and hands when they engage in autopoiesis, but the rest of the body may be clothed as is mutually acceptable to all persons involved. The circle consists of alternating males and females sitting in as small a circle as possible, holding hands with their feet extended. With each foot, each person touches the foot of one person of the opposite sex diagonally opposite him or her. Therefore, each person is touching four different persons of the opposite sex simultaneously, one to each side and two across the circle. This arrangement is shown in the accompanying figure, in which the squares are males and the circles are females; the straight lines represent the points of contact for hands and feet. This seems to produce coherence through touch at the prereptilian brain level among all eight persons. At each meeting all persons might rotate positions so that eventually all possible combinations and permutations of touching occur for all persons during autopoiesis.

Additional coherence might be produced with background music played at a barely audible volume. The best music for this purpose seems to be J. S. Bach's *Art of the Fugue,* which consists of four notes, B-A-C-H (in German notation), and their complements (mirrors) evolving in ever more complex, interwoven, helical patterns which are always incorporating four complementary pairs. (My favorite recording is on the London label, by Munchinger. It is difficult to find. The Ristenpart recording on Nonesuch, or the Mariner on Philips, might be good substitutes.) This seems to enhance coherence in the two middle brains and in the neocortex.

The next level of coherence is a neocortical response by all persons focusing on a solution to a difficult problem. The first such problem might be how they can maximize creativity. This is done by mutual consent prior

A Mandala of Creative Transformation



A symbolic representation of four complementary pairs engaged in Autopoiesis. (Derived from the figure shown on page 223.)

The Lens Grinder

There lived a man of ethics
All he said offended
His writings were forbidden
He lived by grinding lenses

The grinding destroyed his body
The living became dying
The dying could be ended
Only by compromise and lying

He declined the living
And chose the grinding
It is better to die by seeing
Than to live by dying

His life made men see
His death was not empty
His ethics live in me
His awareness—part of infinity

—POTOMAC, MARYLAND
(MARCH 1970)

Evolution

With courage we sail the Cosmic Sea
With love we go to infinity
With fear we make friend an enemy
We are all adrift in entropy

Listen, the cosmic voice within
All who play the Game of Life win
The evolutionary thesis
All each other's autopoiesis

If we create one another
We create more than you and me
You are my sister and my brother
We all need each other in the sea

My brother and sister in truth
We are all one in the Cosmic Sea
Entropic fear is all to lose
You create me as I create thee

—ELKTON, OREGON
(FEBRUARY 1984)

Meditation

Fear Is The Belief I Can't Create
Fear Is An Illusion
I Am Creation
I Now Create

Creation

As We transcend Matter, Space and Time
We Eight are One and now become Nine

to autopoiesis. It might be facilitated by all repeating in unison the poem "Evolution," the Meditation, and the "Creation" couplet *once* before the first autopoiesis. Be careful not to turn a technique into a ritual. Repetitive, ritualistic behavior is almost always destructive. Visual concentration on the creative transformation symbol might also help some persons. Eventually the autopoietic octet should focus on specific, difficult-to-solve problems in the objective world, first by brainstorming them classically, and then by brainstorming them quantumly through autopoiesis. Some will discover that they can add significant new insights through the autopoiesis; but it seems best always to use the classical approach first. If we do not relate autopoiesis to the objective world, it might lead to self-delusion, as with any other mystical process.

Once the autopoiesis is begun, it continues without speaking until persons begin to achieve genuine, new insights into how to solve the problem at hand. At that point, the persons with the insight, while still in autopoiesis with the other seven persons, state their insights to the rest of the group or ask questions of the group. Together the group solves the problem by consensus. If nothing happens, nothing is said. Relax; try not to force the process.

We always terminate autopoiesis whenever any one of the eight persons wishes to terminate it for whatever reason, with no questions asked or judgments made. This is in the spirit that only mutually voluntary associations are ethical or creative. There is no guarantee that it will work every time. For some persons autopoiesis may never work. Autopoiesis is a way of showing ethical confidence in one another and overcoming fear of nonsexual loving contact. If synchronization of thought and mental coherence occurs, it should produce a new collective moral intelligence greater than that of any person in the group, although this type of synchronization may take many repetitions of the autopoiesis process; for some, it may never occur. Clearly, there seems to be no way that autopoiesis can hurt any healthy person. It may, however, be disturbing to paranoids or other schizophrenics. These have been our experiences. It seems that only fear can inhibit the process.

Autopoiesis and Fear

Fear drives us toward repetitive, classical behavior. Fear inhibits communication between our classical and quantum brains. Fear makes us believe that our own imagination is dangerous. This creates a block between our classical and quantum brains. Fear leads us to repeat Information (F) from our Memory (M) rather than risk generating new Information (F) from our Imagination (G). Therefore, fear leads us to speak from our classical rather than our quantum brain during autopoiesis.

Autopoiesis seems automatically to liberate the quantum brain. It apparently takes an effort by the classical brain to inhibit the process. This

effort is manifested by drowning our and our partners' quantum thoughts in classical verbiage from our Memory (M). If everyone simply remains quiet in autopoiesis, we, apparently, liberate the quantum brain without fail. Fear may cause us to repeat our classical thoughts which seemed true in the past and still give us a sense of identity in an ever changing world. Our Memory (M) is an integral part of our ego. The other major part of our ego is our desire for happiness. Our ego seems to be our classical lesser-self, taking its identity from the classical brain. Our soul seems to be our quantum greater-self, taking its identity from our quantum brain—our mystical connection to infinite truth. The ego seems to be driven only by the desire for happiness, the soul only by the desire for truth. To become moral is to merge our ego with our soul and become whole.

In autopoiesis, we can distinguish a classical from a quantum thought. The classical thoughts, images, and feelings seem to flow smoothly and express themselves in conversational sentences that are relevant and rational. The quantum thoughts, images, and feelings may come in short, unpredictable, staccato bursts that may not seem rationally related to what has preceded. The classical thoughts are easy to keep to ourselves while we are in autopoiesis. The quantum thoughts, once we have them, persist and become stronger, until we have described them to our partners. The more we seek to maximize the creativity of our partners with no concern for our ego, the more creative we seem to become.

Therefore, in autopoiesis, as we practice it, we never try to control or lead the process, but rather we let the process work freely on us. We do not make jokes, argue with what anyone else has said, or try in any way to lead the octologue, but remain quiet and egoless until a thought or image becomes overwhelming and we feel absolutely compelled to share it with our partners for their benefit, not for ours, nor to show how clever we are. This may be in the form of a question. Above all, do not be afraid of long periods of silence. These periods seem necessary to liberate our quantum brain from the noise generated by the classical brains and egos of all the participants.

The quantum brain is the seat of ethics, higher love, and total courage. The quantum brain is always a part of something greater than ourselves. It is, apparently, directly linked to the evolutionary force—the source of all creation. It does not seem subject to direct control by the ego or the classical brain, which is a lesser brain. If we let it, the quantum brain can become one with our classical brain so that there are no longer any conflicts between our brains. When this happens we no longer fear our imagination, and we grow to trust our quantum brain, our creative unconscious. Before the integration of our brains is completed, we must rely on our classical brain to test our insights, our intuition, and our conscience, because while we are still afraid, i.e., while we still have only partial confidence in our creativity, we can be driven by fear masked as intuition,

insight, or conscience. When this is the case, we will make errors which can be detected by the scientific method, which is largely a classical process. So long as we are fearlessly determined to scientifically test all of our original ideas, these ideas will always be true. If we become subjectively certain that our original ideas are true and need no testing, then they are almost always objectively false.

Therefore, we begin by always trusting our quantum brain, within the ethical context of doing our best to maximize creativity, never going against our intuition, insights, or conscience. We never do anything we feel is destructive no matter what the rationale or scientific arguments to the contrary. But after we have acted accordingly, we test the consequences of our actions to see whether we have, in fact, increased or decreased objective creativity. We act decisively while remaining open to the fact that all our Information (F) may be false or at best incomplete. We simply do the best we can with what we have, remembering that it is ethical to doubt and unethical to be certain.

Similarly, when our intuition tells us that something is creative, we follow up on it and take the actions we feel are right even if they seem irrational and everyone around us tells us we are wrong. That is how I wrote *The Moral Society.* That is how I discovered the process of Creative Transformation and Autopoiesis. That is how I created and am still creating all my inventions. But recognizing that I may still be driven by unconscious fear, I subjected all these insights to experimental testing in order to correct my errors, if any. My error rate is constantly declining. A revolutionary, new invention I am currently in the process of developing should be a definitive, objective test of the creative transformation theory and practice; the results of these tests and the process for repeating them will be available to all interested parties. Autopoiesis is still in its early, experimental stage. It may still have serious flaws. By testing and developing it together, and then giving one another feedback without fear of error or personal inadequacy, we shall together, through many groups of eight, perfect the process until we create the Moral Society. In order to succeed we need do no more than try our best to maximize creativity without any fear of punishment or expectation of reward. That is how we become moral within an autopoietic octet. In turning on the quantum brain, we do not turn off the classical brain, but, instead, we seek to harmonize the two brains. In so doing we harmonize with others through love and jointly we become moral.

Creative transformation is a testable hypothesis about the evolutionary process. If you tested it, as specified, to your satisfaction and it has not worked, you may dismiss everything I have said as nonsense. But do not reject the idea before objectively testing it. Certainty is a manifestation of fear. In any case, you should not be afraid to test a harmless hypothesis and prove it wrong. Whatever the outcome, it can only increase objective truth.

As a minimum, you will know that something does not seem to work, although excessive fear among any one of the eight is enough to keep it from working; only your own fear can inhibit your own creativity. As a maximum, you will have begun the Moral Society and made a quantum leap in your own creativity. Therefore, the investment of time in this experiment may be worth your while.

Let your conscience guide you in this and in all matters. Just do not be driven by fear, or rationalize that your fear and your conscience are the same. Your fear is an illusion. Your conscience is your true sense of right and wrong. It is your desire for truth. When someone who you believe seeks to teach you truth recommends an objective experiment, do not dismiss it out of hand because it seems strange. So long as there is no way to produce harm, any experiment can only increase truth. You can evaluate the process of autopoiesis and creative transformation in general by seeing how much your personal creativity increases in the objective world and how much your fear decreases in the subjective world. If you follow the path recommended in this book, your personal creativity may increase enormously. You will become creatively transformed, if you choose to do so.

Conclusions

This, of course, is only the first step in the process. The process itself will tell you what the next steps should be. As was mentioned, we are currently working on a more advanced form of autopoiesis, without touching, based solely on electromagnetic resonance of brainwaves. This is a potential side effect of my new invention, which may turn out to be more important than the main effect. You should develop the creative transformation theory and experiment with autopoiesis as you see fit. You have nothing to lose but your fear. You can count on help in becoming creatively transformed from others who have already begun the process.

I hope that you can use the book that follows to guide you and those you love in the process of Creative Transformation. This is clearly not the last word on the subject. It is only a beginning. It may even be wrong. You are ethically obligated to improve the process, if you can. The only measure of the success of this process is how much it increases the objective creativity of those who engage in it. However the process of Creative Transformation begins, it seems to me that it might involve the following features and lead to these conclusions:

1. Participants begin by wanting to be more creative and recognize that they may have delusions as well as emotional or personality problems which are impeding their creativity; they must value truth more than happiness.
2. Participants eventually begin to help all other participants become more creative, and value the increase in the creativity of another as

much as they value the increase in their own creativity; the most creative thing we can do is help increase the creativity of another. All creative human organizations, from families and businesses to nation-states, are faltering steps in this direction.

3. Participants then consider the hypothesis that the next quantum leap in evolution might logically involve the creation of collective superhuman creativity such as to make each individual more creative in an octet than he or she is alone. All eight participants must then choose to make this quantum leap.
4. The participants then consider the hypothesis that we might all be biologically incomplete and that we complete ourselves only with at least one person of the opposite sex who has a brain complementary to our own; the participants should recognize that we apparently cannot become moral alone. We seem to achieve morality solely by helping others achieve morality.
5. The participants may then see the hypothesized pattern of evolution, going back to the beginning of our local finite universe, in which all evolutionary jumps are apparently made by systems of complementary pairs; then they may see that the theme of new systems of four complementary pairs forming a new hierarchy of evolution is a recurring theme in nature; human autopoiesis in the moral dimension seems a natural extrapolation of this processs.
6. The participants might then make a personal quantum leap of a purely subjective nature and consider, while suspending belief, that our local finite universe might have been created by a nonlocal Moral Society outside of our time and space in the infinite universe of all universes. Our local universe might have been created to create more moral societies, which would then evolve beyond time and space and, together with the Moral Society that created them, create new and better universes of their own. The entire process of infinite creation that has no beginning or end might be God. The infinite source of true information in the quantum universe outside of time and space might be God. We might all be evolving toward becoming an ever greater part of God in quantum leaps of four complementary pairs. We might create God as God creates us; this is Universal Autopoiesis; this is Creative Transformation within God as an infinite process which contributes to us as we contribute to it. We always seem to get much more out of the process than we put into it, so long as we give something of ourselves. However, if we give nothing, we apparently receive nothing.
7. It seems that when we do our best to be ethical and become moral by loving others, we open up our minds to a direct communication with God as an infinite process. This seems to be the basis of all

creativity. The only thing that can apparently stop us is our own fear. We can conquer all fear by doing our best to love others. Autopoiesis between four complementary pairs of men and women may help us overcome our residual fears and teach us to love others, including our enemies, so that we become moral and, potentially, infinitely creative.

8. The philosophical-ethical basis for the preceding concepts are in The Gospels of Jesus, in *The Ethics* of Spinoza, in the writings of Teilhard de Chardin, and also in all of my books, including this one. I also recommend Fred Hoyle's *The Intelligent Universe* for a recent, different perspective on a similar theme, plus Erich Jantsch's *The Self-Organizing Universe,* David Bohm and F. David Peat's *Science, Order, and Creativity* together with many other Bantam New Age Books and the New Science Library (see Bibliography in this book).

All the preceding ideas and observations may be in error. However, we cannot use our fear of error as an excuse for not communicating our ideas to those we love. When we fear error, we cannot create. All fear is entropic. Only fear makes us destructive and impedes our creativity.

My brother and sister in truth, never fear any idea, your own or another's, no matter how strange. Share all your ideas with those you love. If you are creative in your love, they will help you correct your errors. The sharing of objectively testable ideas can only increase the creativity of all who share. Only your fear of sharing ideas and thoughts can hurt you and make you less creative. Only by loving each other can we overcome all fear. Let us create one another.

PART I

The Evolutionary Perspective

The *Andromeda Galaxy* is the closest galactic system that is moving toward our own, the Milky Way. (Photo courtesy of the Hale Observatory.)

CHAPTER 1
The Evolution of Matter

The evolution of humanity is part of the evolution of the universe. The universe is an interconnected whole whose individual parts cannot be fully understood in isolation from one another. You can best understand human evolution and your own creativity by first understanding the physicochemical process which led to you.

Cosmology

The observable universe is by the best current estimates between 15 and 20 billion (1.5 to 2.0×10^{10}) years old [689]. The sun, the earth and the planets are about 5 billion (5×10^{9}) years old [695]. The first question that comes to mind is, "What existed before the observable universe?"

The most amazing aspect of this question is that it can be answered at all. We can answer this question because we can actually look back in time and see what the universe was like billions of years ago. Light travels at a finite speed of about 300,000 kilometers per second. When we look at the most distant parts of the universe, we are seeing the universe as it appeared when light from that part of the universe began traveling toward us. Among the most distant parts of the universe which can be observed today is a quasar discovered in 1986, estimated at over 13.5 billion light-years away, which is to say that the light reaching us from there today began traveling toward us over 13.5 billion years ago. In 1988, a galaxy which appeared to be 15 billion light-years away was discovered. The most notable observable fact about the distant parts of the universe is that, with two possible exceptions, they are very much like the closer, visually older, parts. The two exceptions are that (1) matter in the universe seems to be receding from us and itself (i.e., distant clumps of matter all recede from one another) at ever greater speeds in direct proportion to its distance from us and itself respectively, and (2) there are some peculiar objects called quasars which seem to be more numerous at greater distances, i.e., quasars seem to have been more numerous when the universe was younger.

The Expanding Universe

The units of matter in the universe seem to be receding from each other. What constitutes a unit of matter is quite arbitrary. For cosmological purposes it is currently convenient to consider a galaxy as the elementary unit of matter. What galaxies are and how they are formed we will consider later. For now we merely consider them as semi-autonomous particles of matter of roughly the same size.

The Newtonian model of universal gravitation would predict that if a system of particles existed, the particles would tend to cluster together by mutual gravitational attraction unless there was an outside force applied to this system. Since the galaxies are receding from one another, there must be an outside force. Depending on what we assume to be the nature of the outside force, we deduce different cosmologies.

The Big Bang Theory

Under this theory, it is assumed that all matter in the universe was once concentrated in a mass at a single point, possibly a sphere of zero diameter. This super-dense mass is sometimes called "the primordial atom" or the "cosmic egg." More technically, it is sometimes called the "cosmological singularity." This super-dense mass caused an enormous explosion similar in quality to a hydrogen bomb, but vastly more powerful. This in turn caused all matter and space to explode out from a common center, which is the reason for the observed expansion of the universe, i.e., it is a continuation of the original explosion. Time, matter, space and all physical laws all came into being within the first few instants of the Big Bang. Actually it is space that is expanding and taking matter along with it.

This very simple model of the universe makes reasonably good predictions about many observed natural phenomena, such as the age of the universe and the observed background energy of the universe, i.e., the residual background black-body radiation from the Big Bang. It is clearly too soon to say if the Big Bang model is correct. It is merely one of many reasonable cosmological models. Its major immediate difficulty is philosophical: The questions which immediately come to mind are, (1) Where did the cosmic egg come from? and (2) What will become of the universe in the future? According to the Big Bang theory there may be one common answer to both questions.

If the total mass of the universe is sufficiently large and the original explosion was not too powerful, then the universe will eventually begin to collapse again by mutual gravitational attraction (the "Big Crunch") until it again becomes a superdense plasma and explodes. This process goes on forever and we have an oscillating universe which periodically expands and

evolves and periodically contracts and disintegrates. This universe is finite and closed in space but cyclically infinite in time.

An oscillating universe is quite compatible with certain Eastern philosophies, such as Hinduism, which believe that because nature is a cyclic process, there is no true progress. To Western philosophies, which take the view of continual progress starting from a more primitive state, the oscillating universe is an inherently unsatisfying model. Judaeo-Christian and Marxist belief, as well as Darwinism, imply a continuous progress from a single starting point. Furthermore, some empirical evidence, such as the residual black-body radiation, imply that there was only one Big Bang and not an infinite series. The residual black-body radiation is the average temperature to which the universe was heated by the original Big Bang. This temperature, which is about 3° Kelvin (-270°C), is consistent with a single Big Bang, but it would probably be higher if there were a series of Big Bangs. Actually all the cosmological theories are incorrect in the precise radiation predicted. Therefore, they all probably have serious errors. All paradigms are false or incomplete.

A Big Bang model without oscillation is inherently more satisfying to those who subscribe literally or intuitively to Judaeo-Christian belief because it implies the notion of a first cause—God being the creator of the Big Bang. "History" plays the role of "God" for Marxists. We note that one of the originators of the Big Bang theory was a Catholic priest, the Abbé LeMaitre. Another major contributor was George Gamow, a refugee from Soviet communism in the early 1930s. Few persons can separate their scientific ideas from their ideology. The problem is that there are even more philosophical difficulties with a single-event universe than with an oscillating universe. The "God," or "history," hypothesis may be a scientifically inadequate way of describing what existed before the Big Bang. If every time we encountered a hard-to-explain event we merely said "God caused it," then there would be no scientific, technical or intellectual progress. This is not to imply, however, that God or gods in some sense do not exist. We must try to seek explanations which are consistent with observed or derivable facts and not introduce any unnecessary conjectures to our scientific models. A good alternative to the Big Bang is the steady state model.

The Steady State Model

This model, first proposed in the late 1940s by Gold, Bondi, and Hoyle [771], represents a radical departure from orthodox cosmology, because in order to explain all the observed facts it assumes an unobserved fact. The fundamental assumption is that matter is continuously being created within the universe. The creation of matter was at first assumed to be a very slow and modest process, producing only one atom of hydrogen for every cubic centimeter of space every thousand years. This is a phenomenon which is

not yet measurable under laboratory conditions on earth. Therefore, the assumption does not contradict any existing facts; but it does violate the first law of thermodynamics, which says that energy, and therefore matter, can be neither created nor destroyed. Matter and energy may interchange forms, but their sum remains a constant. However, this "law" is based on the fact that no one has ever actually observed the creation or destruction of energy and not on some more fundamental premise. Furthermore, the single Big Bang implies a one-time, instantaneous creation of all matter and energy. Therefore, the hypothesis of continuous creation may be scientifically valid and it is not really assuming more than the Big Bang theory.

The important thing to keep in mind is that all scientific models are only approximations to reality. In science no model is ever held to be absolutely true and beyond doubt or improvement. We simply tend to tentatively accept as "true" the model which makes the best predictions until another model comes along which makes better predictions. Then this model in turn becomes the "true" model. If two or more models are equally good at predicting, we tend to accept the simplest model which makes the fewest assumptions and/or is easiest to use. Science is therefore a pragmatic process which seeks only to improve humanity's ability to predict its total environment. The upholding of some specific philosophical or ideological premise at the cost of simplicity and/or predictability is contrary to the scientific spirit. In science only what can be shown to work is regarded as tentatively true. At best, the scientific paradigm is true but incomplete.

The steady state model is therefore contrary to neither the spirit nor the facts of science. We have introduced one unobserved fact into the cosmological process in order to explain all the observed facts. If the steady state model is correct, then we can make many predictions about the nature of the universe that are contrary to the simple Big Bang models. If observation verifies these predictions, then we tend to accept the steady state model. If observation contradicts the predictions, then we look for a better model.

Hoyle's latest version of the steady state model [771] explains the expansion of the universe as a result of the pressure being created by the unexplained generation of new matter; the unit of creation is not now a single hydrogen atom, but rather a galaxy—a mini-Big Bang, if you will. Galaxies begin as white holes similar to quasars. The old galaxies move out to make room for the new galaxies and this process goes on forever. The universe is infinite in space and time. Although the universe is dynamic and in constant progress, one part of the universe looks very much like any other part, and from each part the universe appears the same. That is to say there is no privileged position in space or time from which the universe as a whole looks different.

All these features of the steady state model have intuitive appeal for

those who have difficulty accepting either (1) a finite universe which started from nothing and is becoming nothing by spreading out into infinity, thereby becoming increasingly diffused until all matter exists in total isolation (i.e., all the particles of matter are 20 billion or more light-years apart and can no longer be observed one from the other), or (2) a finite oscillating universe which is constantly expanding and contracting in an endless cycle which leads nowhere—a cosmic treadmill without progress.

But intuitive appeal and satisfaction have little to do with scientific validity. Scientifically, we can accept the steady state model only if it makes correct predictions.

The steady state model seems to make correct predictions about everything that is observable in the universe except possibly (1) excess helium, (2) quasars being concentrated at cosmological distances, and (3) elementary particle physics. Fred Hoyle is currently adjusting the theory to compensate for these discrepancies [771]. Even the residual black-body radiation can be made compatible with this model. The structure and distribution of galaxies seems better predicted by the steady state model than by the Big Bang model. However, there is more helium in the universe than is predicted by the steady state model—about 25% of the total universe; and this is precisely the amount of helium predicted by the latest version of the Big Bang model, which assumes an infinitely condensed, very hot initial cosmic singularity. This is in complete agreement with particle physics, which predicts a 25% helium universe.

Quasars seem to be the most amazing and difficult-to-explain objects ever discovered. The answer to "What is a quasar?" will determine in part whether the steady state model is accepted in some form or is rejected. Right now the major argument for the Big Bang theory is that it is the simplest model which makes the best predictions except for the structure of galaxies. It also unifies cosmology and particle physics. However, all current cosmological models will probably eventually be replaced by a more elegant model. In order to discuss quasars, we must first understand the nature of galaxies.

Galaxies

A galaxy is an interacting system of up to several hundred billion stars. Our own galaxy, the Milky Way, has a mass of about 2.8×10^{44} gms or about 1.4×10^{11} times the mass of our closest star—the Sun [695]. If all of this mass represented stars, then our galaxy might have well over 200 billion stars. However, many stars are much more massive than the sun and some of the mass of the galaxy is contained not in the stars but in the clouds of interstellar dust from which new stars may eventually condense [357]. The mass contained in the planets is negligible. More will be said of stellar evolution later. For now we consider stars as particles of matter which make

up the systems called galaxies, just as galaxies were considered particles in the system of the observable universe.

Galaxies are of four major types: spirals, barred spirals, ellipticals, and irregular galaxies that are neither spirals nor ellipticals, and may range from exploding galaxies to ring-shaped galaxies having almost any shape. Our own galaxy seems to be a spiral of over 100,000 light-years in diameter, very similar to Andromeda, which is the closest major galaxy at about two million light-years distance. Like Andromeda, our galaxy has two smaller satellite galaxies called the "Magellanic Clouds," which are about 163,000 light-years away.

As was mentioned earlier, observational evidence from several independent sources indicates that the galaxies are, in general, all receding from each other. Andromeda and our own galaxy are among the few exceptions and are approaching each other. Galaxies occur in clusters and the clusters in superclusters. Within any given cluster, the galaxies are gravitationally bound and may be approaching each other. The latest evidence is that galaxies cluster along the surface of spheres and may not be on the average uniformly distributed within the universe, at any scale—another possible argument against the steady-state model, as well as against the Big Bang model. It has also been observed that the speed of recession is in direct proportion to the distance between the galaxies. This relationship may not be quite linear at the extreme distances; but out to several billion light-years, a linear approximation to the recessional speeds of the galaxies applies. The recession speed itself is measured indirectly by means of the galactic red shift.

The red shift of the closer galaxies can be independently shown to be due to the Doppler effect of the speed of recession. The greater the speed of recession, the greater the red shift. This is analogous to the decrease in pitch of a sound such as a train whistle which is moving away from us. The faster it moves away the lower the pitch. Hence, the faster a galaxy is moving away from us, the further its spectrum will be shifted toward the red.

Independently of their red shifts, older stars tend to be reddish and young stars tend to be bluish. Irregular galaxies consist mostly of young, blue stars. Spiral and barred galaxies tend to have old, red stars near their nuclei and young, blue stars in their spiral arms. Elliptical galaxies tend to consist mostly of old, red stars. From this one might conclude, speculatively, that as galaxies condense from hydrogen gas and interstellar dust into an irregular cloud, stars begin to condense and glow blue. As the galaxy ages, it increases its speed of rotation and the older stars remain near the center while new stars continue to be condensed in the spiral arms. As the galaxy grows still older it loses its energy through radiation and begins to slow down, losing its spiral or barred arms to become elliptical, until it ends as a dense globular cluster of old stars collapsing upon itself. Elliptical and irregular galaxies may also come from collisons between spiral galaxies.

Some globular clusters are estimated to be over 13 billion years old. An old globular cluster which heats up as it collapses upon itself might undergo a mini Big Bang and spew out its material into the universe, where it will eventually end up as part of other younger galaxies, or it might collapse into a massive black hole which produces the effect of a quasar while all the matter is collapsing. The Big Bang theory does not predict the structure of galaxies. In order to see whether these hypothetical mini Big Bangs are an explanation for the quasars, we must go into some detail about how stars evolve.

Stellar Evolution

As we indicated earlier, a basic building block for the evolution of the universe is hydrogen, which is the simplest and by far the most abundant element in the universe. Since according to the steady state theory it is hydrogen and not other elements which are being created by a field effect of time, space, and matter, it is natural that hydrogen should be the most abundant element. The first question which comes to mind is, "Where do the other elements come from?" This is one cosmological question that has been thoroughly explored and adequately explained. All the elements other than hydrogen and some helium are synthesized from hydrogen and helium in the centers of the stars or are created in the process of the disintegration of a star in a supernova. There are other astrophysical evolutionary processes, such as slow neutron capture in the envelopes of the red giants.

Consider a universe of pure disassociated hydrogen with zero momentum. The hydrogen atoms will condense into clouds by gravitational attraction. As a cloud grows it attracts still more hydrogen and begins to contract into a spherical shape. As it contracts it begins to heat up from the increasing number of collisions between the ever denser hydrogen atoms. Eventually the hydrogen nuclei at the center of the cloud are so energetic, at about 10 million degrees, that they fuse and become helium nuclei. This causes an enormous release of energy, as in a hydrogen bomb, which causes the cloud to explode outward and overcome the gravitational collapse. There is a balance established between the gravity making the star collapse and the nuclear explosions making the star expand. The more collapsed the star becomes, the more energetic are the nuclear explosions making the star expand. Therefore, the star, if it is not too big, becomes a homeostatic, self-regulating system that will burn for billions of years until almost all of its hydrogen has been dissipated. Our own sun is an average star estimated to have an expected lifetime of about 10 billion years, half of which is over. The larger the star, the sooner it will disintegrate and the hotter it will burn. Very small stars that never quite catch fire are called "brown dwarfs."

Eventually much of the hydrogen at the core of stars larger than a brown dwarf will be converted to helium. Then the star is made of a large

percentage of helium. There is then less energy available to keep the star from collapsing and it begins to undergo gravitational collapse again, becoming even hotter until it reaches a temperature of about 100 million degrees at its center. At this point the helium nuclei themselves begin to fuse and release even more energy than from the fusion of hydrogen nuclei. The hydrogen nuclei continue to fuse in the upper regions of the star. The star now becomes extremely hot with a helium core and a more diffused hydrogen atmosphere. This type of star is called a "red giant." When the sun becomes a red giant in about two or three billion years, it will extend out beyond the orbit of the earth. The earth and all the inner planets will be destroyed while the outer giants, Jupiter, Saturn, Uranus and Neptune, together with their moons, may become more hospitable.

When helium fuses it undergoes a series of complex nuclear reactions which eventually lead to carbon and oxygen. When the helium is exhausted in the star, the star can go two ways; it can become a supernova or a white dwarf made mostly of carbon. Stars between the size of a brown dwarf and about four times the size of the sun become white dwarfs with a density of 10^6 gms/cm^3. Stars much larger than this become supernovae. In these large stars carbon and oxygen undergo fusion through a gravitational collapse leading eventually to the formation of iron and all the intermediate elements such as neon, sodium, magnesium, aluminum, silicon, and sulfur. Supernovae collapse into a neutron star or totally disintegrate soon after fusion occurs in the carbon core. A neutron star is made up of collapsed matter in which no atoms but only neutrons exist. A teaspoonful of matter from such a star would have a mass of over 60 tons. A neutron star may have as much mass as the sun but be only 10 miles in diameter. The smaller stars produce very few elements heavier than carbon. Stars that are much more massive than the sun are the ones which produce most of the elements between carbon and iron. Elements heavier than iron are not produced by fusion in the core of the stars, since the fusion of elements heavier than iron consumes instead of produces energy; rather, the heavier elements are formed primarily by slow neutron capture in the envelopes of the red giants and by fast neutron capture just outside the core of the giant stars as they are exploding into supernovae.

The supernovae themselves produce various remnants, such as neutron stars, which are probably the source of the pulsating radio stars, planetary nebulae, and possibly black holes.

Black holes are amazing objects which are predicted by the general theory of relativity. In these objects a collapsed star, after undergoing a supernova explosion, is so massive and its gravity so strong that nothing can escape from it—not radio waves, light, or particles. It is the deadend of matter. We can detect black holes primarily by their gravitational effects. If elliptical galaxies collapse into black holes they might produce an effect similar to a quasar.

As matter falls into a black hole it emits massive amounts of radiation in a type of death scream until gravity overcomes it. It is believed that at the center of each galaxy is a massive black hole. Stephen Hawking has shown that it is also likely that small grain-sized black holes were created during the first few instants of the Big Bang. He has also shown that in the long run black holes are stable in proportion to their size. Some of the small black holes may be exploding while the large black holes will last tens of billions of years. The nature of black holes may help us understand quasars.

Quasars

There are objects in the sky which by their red shifts are estimated to be at extreme cosmological distances. Some have been detected at well over 13.5 billion light-years—or so it seems. However, these objects emit energy in such massive amounts that if they were truly at the distances which their red shift indicates, then they are entire galaxies in which all the matter is being converted to energy at a rate which cannot be explained by the nuclear fusion processes which go on in stars. Furthermore, these Quasi Stellar Objects (QSO's), or "quasars" as they are called, sometimes vary in intensity periodically with some periods as short as a day. (The first QSO's discovered were radio emitters and were called Quasi Stellar Active Radio Sources or "Quasars." QSO's which did not emit radio waves were found later, but "quasar" stuck.) This implies that some quasars are probably not more than a light-day in diameter or about the size of the Solar System, yet they emit much more energy than an entire galaxy.

The size limitation is due to the fact that if an object is undergoing periodic changes over the entire object, then these changes cannot propagate over the object faster than the speed of light. The special theory of relativity states, and experiment confirms, that matter and energy cannot transcend the speed of light within the observable universe, at least not by known means. Observational data indicate that quasars are starlike in visual appearance, since they have no observable shape as do the galaxies and appear as points of light as do the stars. Very distant galaxies also appear as points of light.

In summary, the preponderance of evidence indicates that quasars are very distant objects with masses at least as great as a galaxy, sizes often not much greater than a solar system, and energy outputs so enormous that no known physical process—except possibly the collapse of a galaxy into a black hole at its nucleus—can explain them. If the mass of a galaxy were being converted to energy at the same rate as it is in a quasar, it would only last about 100,000 years; yet all the observed galaxies seem to be many billions of years old. But perhaps the destiny of all galaxies is to collapse into black holes.

The first theory that some cosmologists developed in order to explain quasars was to hypothesize that they were not at the distances indicated by their red shift but were giant stars within or near our own galaxy. A quasarlike red shift can occur if the object emitting light is extremely massive or receding at a very high velocity. Then relativity predicts a red shift. Actually all light is shifted at least slightly to the red by gravity. When an object is extremely massive, then the red shift is so great that no light at all escapes as in the case of a black hole. However, stars sufficiently massive to produce a red shift of this dimension can easily be shown to be unstable. Such a star would quickly explode, and what remained either would become a black hole and/or condense into separate new stars. By studying old astronomical photographs we know that some quasars have had the same average brightness for at least 85 years, although in the past it was not known that these objects were quasars (they were thought to be ordinary stars). Furthermore, no known energy source or process could accelerate a nearby star to a velocity approaching the speed of light. Therefore, we are left with the inescapable conclusion that quasars are at extreme cosmological distances and/or all the models of the universe are in serious error. The latter case is not improbable.

One possibility for error which is currently being studied is that the physical constants of the universe, such as the gravitational constant, the electromagnetic constant, and the speed of light, are indeed variables which change very slowly with time. This theory was first propounded by Dirac in the 1930s [357]. Fred Hoyle has done some modeling with a universe in which the gravitational constant decreases one part in 10^{10} per year [357]. This could not be detected in a laboratory, but it would have enormous consequences for all cosmological models, often reversing predictions. In short, cosmology can currently be said to be in a state of rapid change with no clearly superior model, although the Big Bang is by far the most popular model among scientists. Yet there is still much which can be said of the evolution of the universe. Consider the speculations in the following section.

Cosmological Synthesis

The universe is infinite in temporal and spatial extension. A steady state model describes the universe as a whole. Throughout the universe there are Big Bangs (or mini-Big Bangs, if you prefer), occurring. Each Big Bang creates a mini-universe of its own, a bubble within the larger universe. Within each mini-universe the laws of physics including the nature of space, time, and matter, vary as a function of the size, mass, and age of the bubble and the conditions under which it was created. The bubbles themselves are unstable. As a mini-universe ages, it expands and the gravitational constant becomes weaker. Eventually the bubble bursts and the laws

of the mini-universe become the laws of the universe within which it is contained. Each universe hatches another universe. Within the larger universe the laws of the mini-universe do not apply, but it has laws of its own. Each universe has its own space, time, matter, and set of physical laws. There is perhaps an infinite hierarchy of universes, each one contained within another, each one with laws of its own. Bubbles within bubbles within bubbles.

The gravitational constant is inversely proportional to the size, mass, and age of the bubble. Planck's constant varies from universe to universe. We note that some bubbles may contain infinite mass, i.e. infinitely many bubbles, but each bubble must be of a smaller order of infinity than the bubble which contains it. The mathematical concept of a hierarchy of nested infinities applies here [556, 652]. In our universe, as galaxies reach the speed of light relative to one another, they undergo a relativistic contraction and become increasingly thin, so that it is possible to pack an infinite number of galaxies in a finite volume. The mass itself is merely an area of curvature within the bubble as is indicated by the general theory of relativity. When the curvature becomes sufficiently great in the positive direction, we have a black hole, which is a direct exit from the mini-universe into the larger universe which contains it—a bursting of the bubble. When the curvature is sufficiently great in the negative direction, we have an entrance from the larger universe into the smaller universe. This area of high negative curvature is a quasar, or a "white hole." The quasars are more probable at the periphery of the bubble and represent a puncturing of the bubble from without. They produce more energy than is possible within the smaller universe because they represent a streaming of energy from the larger more energetic universe into the smaller, less energetic one. Eventually all the matter in a universe consists entirely of quasars and black holes and the universe is completely open to and from the larger universe. It has ceased to exist.

Although the quasars and the black holes are both unstable, within the larger universe the quasars play the role of protons and the black holes play the role of electrons, or they are some other analogue of elementary particles. No elementary particles in any universe are ever stable; they are always collapsing from within and from without. The bubbles become open from without and from within and merge with other bubbles to create an infinite variety of universes.

Within any given bubble there are new bubbles being formed. The frequency of bubble formation changes with time because the relationships between the physical constants are changing as their values change. The mini-Big Bangs within our own universe are not the supernovae but the creation of quasars. Protons and electrons are being generated in our universe from the quasars. Quantum phenomena result from the random punching of portals from and to the universes, within and without. These

phenomena are random because they are partially determined by forces outside our universe which we can neither predict nor control. These forces are "hidden variables" outside of our time and space. Within any universe there is a smallest possible bubble. Within our universe that smallest possible bubble is one quantum of energy.

The preceding is, of course, all speculation and may contain logical or factual inconsistencies which either could be analytically evident or could manifest themselves by the inability of this cosmological model to make correct predictions. If the model is correct, a unified field theory may be derivable from it. However, the main reason for this cosmological speculation was not necessarily to derive a correct model but to show the kinds of thought processes one must go through in creating new models, which are always necessary to make all the existing facts consistent and then to be able to predict new facts. This model, for example, predicts that quasars are truly at cosmological distances and must be more common at these distances. Indeed, as we observe ever farther out we should find ever more quasars. The fact that observed quasar density begins to fall off at about 8 billion light-years is due to the red shift, which makes the quasars increasingly difficult to observe until they become invisible at about 15 billion light-years. The quasars are the major points, but not the only points, where matter is being created. This is why they are so energetic. At the time of our local Big Bang, our universe was one giant quasar. The energy for this Big Bang came from the larger universe in which we are contained. It was a puncturing of the fabric of space-time which created our own universe with our own peculiar laws. The bubble began to expand from within by our own laws and from without through subsequent smaller quasars. Eventually our universe will be entirely made up of quasars and black holes in dynamic interaction governed by the laws of the larger universe which contains our mini-universe. We will have become as we always were, matter within the larger universe.

As was mentioned, the outstanding cosmologist Stephen Hawking has estimated that black holes are unstable and will eventually explode after periods much longer than the current age of the universe. Even protons and neutrons seem to be unstable. In the long run nothing remains the same. Everything is eventually transformed into something else. At the cosmological level, therefore, we see a pattern of galaxies, quasars, and black holes, joining in a system to form an integral part of vastly larger and more complex systems. At the micro-level we see the same pattern where quarks, electrons, and protons join together in a system to form our local mini-universe. In between there is a whole spectrum of physical, chemical, biological, and psychosocial evolution. Since there is no bubble less massive than a single quantum of energy, our universe may be near the bottom of a cosmological evolutionary ladder that extends up to infinity. In order to see humanity's place in the cosmic scheme of things and better

understand the total process of general evolution, we begin to trace the process which led from matter to us. Eventually this process will lead us again to cosmological considerations in Chapter 5, where we consider another cosmological model based on the deeper aspects of quantum mechanics. The macro and the micro are intertwined in a coherent whole within the infinite hierarchy of all the universes that have ever existed and ever will exist.

The Evolutionary Perspective

All cosmological models are highly speculative. If we look at these models, starting from Genesis in the Bible and ending with the steady state model of Hannes Alfven [10], which assumes a universe permeated by plasmas, we see that all of these models had to be radically altered as new facts were discovered. Yet each of the models has a certain level of truth and meaning, and makes unique predictions. Genesis still has relevance if we interpret the Biblical account figuratively and not literally. Many modern theologians, including some within the Catholic Church, use this figurative interpretation. Remember that the Bible, by its own account, is an ancient narrative of reality written by imperfect men, not by a perfect God. Since then, many distortions may have been introduced by imperfect copying and even more imperfect translations. The chronological sequence in Genesis is in close agreement with the best scientific estimates, and the six days of creation can be considered as six epochs. Man being made from mud and the Garden of Eden account can be interpreted as man evolving from matter and becoming animal and finally human (an ethical being). Leaving the Garden of Eden was not a "fall," but an ascent to assuming ethical responsibility for our own evolution rather than being the obedient pet of a despotic God.

Later we will show that humanity has an intuitive, unconscious grasp of evolution because it is an integral part of it. The universe seems to have a holographic structure in which each part reflects the whole. We can perceive evolution directly because we can perceive our own existence directly. This direct perception of self in an evolutionary context expresses itself in religion and art. These are ways in which we integrate dimly perceived unconscious knowledge in a conscious symbolic synthesis. All this we will show within the context of psychosocial evolution. At this point it is only necessary to indicate that evolutionary modeling is an essential part of being human. We all either speculate on evolution or accept others' speculations, as in the case of religious adherents.

As was indicated earlier, models about the evolution of stars are much less speculative and are on firmer ground than models about cosmological evolution. We can observe our own star, the sun, at close hand and do laboratory experiments, as in the case of nuclear fusion, which can test our

hypotheses about stellar evolution. Knowing how stars evolve, it is easy to explain how planets evolve.

The Evolution of Planets

As was stated earlier, stars evolve from the gravitational collapse of a cloud of hydrogen, helium, and other matter. Recently there has been a unification between particle physics and Big Bang cosmology. This unification predicts that at the time of the Big Bang, 25% of all the matter was converted into helium from the primordial hydrogen, and 75% remained hydrogen. This agrees with observation. It is further evidence in favor of Big Bang cosmology, although the same result can be obtained by assuming that each galaxy begins as a mini-Big Bang from a white hole, and part of the hydrogen is converted into helium.

As the sun was condensing by gravity into a dense cloud it began to spin. This resulted from the conservation of angular momentum. The dynamics of a gas cloud condensing under gravity are fairly well understood, and the results are predictable.

As the cloud condenses it spins ever faster. The centrifugal force causes it to become disc-shaped, similar to a galaxy. Then rings begin to form in the outer parts of the disc, and a spinning spherical nucleus is formed in the center by transferring angular momentum to the planets, as predicted by Hannes Alfven, through electromagnetic fields—again, as with a galaxy. We see an analogy of this today in the planet Saturn. (Note that Jupiter, Uranus, and Neptune also have rings.) The rings themselves are unstable and break up into new spherical shapes, many of which crash into one another, e.g., planets and comets. If these spheres have sufficient mass, they will become stars themselves, and we will have a multiple star system, such as abounds in the universe. If the spheres are smaller than the critical size, they will become comets, asteroids, planets or satellites of planets like the moon.

The larger planets, such as Jupiter, Saturn, Uranus, and Neptune, will have enough of a gravitational field to retain part of their hydrogen and helium atmosphere, although, except for Jupiter, most of this atmosphere will be lost to outer space. In the smaller planets the atmospheric hydrogen and helium will be almost completely lost to outer space. However, chemically bonded hydrogen is retained as in H_2O. In the smaller planets, such as Mars, even H_2O in its disassociated form is eventually lost because of weak gravity. If Mars had been a little larger, it would have been an earth-like planet, since it is within the ecosphere of the sun [400].

The largest planet, Jupiter, is actually a star which did not quite make it. It radiates more energy than it receives from the sun, but it does not have enough mass to engender a nuclear reaction even at its center. The radiant energy of Jupiter is probably due to a slow gravitational collapse. But Jupi-

ter is too small to even be a brown dwarf. Jupiter has an atmosphere and surface of fairly complex molecules. Sagan has estimated that Jupiter probably has a higher probability of engendering life within its atmosphere (not its surface) than any planet of the Solar System other than earth [705].

While hypothesizing about life evolving on non-earthlike planets is a highly interesting, speculative exercise, it is not central to our problem of developing a generalized model of the evolutionary process. We need only assume that evolution can occur on any earthlike planet, and note that in our galaxy alone the expected number of earthlike planets is enormous, since there are at least 100 million sunlike stars [676, 705]. On any earthlike planet around a sunlike star, chemical evolution is, up to a point, a natural consequence of the laws of chemistry.

Chemical Evolution

All the basic elements given in the periodic table evolve from the nucleons making up hydrogen. The nucleons themselves either (1) are being continuously created as a function of time, space, and matter (steady state model), (2) were created at a single point in time and space (the Big Bang), or (3) always existed and always will exist in either an infinite or a finite universe (e.g., Hannes Alfven's steady state model [10]). Given that a sufficient mass of elements exists to create the solar system, the rest of the evolutionary process follows directly and inexorably. We may speculate about cosmic evolution or simply say we do not know and may never know about the origin and destiny of time, space, matter, and natural laws; we merely take them as a given for now and will get back to them later within the context of humanity's evolutionary future.

Cosmic evolution involves elementary particles becoming organized into atoms and eventually into galaxies, stars, and planets. This process seems predictable and seems determined by the existence of energy and current natural laws. Chemical evolution involves atoms becoming organized into molecules.

Molecules are formed by the interactions of the electrons surrounding the nucleus of the atoms. This process is primarily electromagnetic and seems to be almost completely independent of nuclear forces and gravity. Chemical evolution is a characteristic of planets, but it is not confined to planets. The basic organic molecules of life may have been formed, or have already existed, in the cosmic cloud from which the sun and the planets condensed. These molecules have been detected in the interstellar clouds as well as in the atmosphere of the sun [527], and they may still be synthesized there [359, 360]. However, the early earth provided an adequate environment for all aspects of chemical evolution.

As the earth was condensing, the iron, nickel, and cobalt sank toward the center of the cloud, forming the molten core of the earth; then the next

heaviest elements, such as silicon, aluminum, sulfur, etc., condensed to form the crust of the earth. In this stage, elements were highly reactive and combined with some oxygen, hydrogen, and nitrogen in the still-hot atmosphere to form chemical compounds such as the aluminum silicates and the pyrites, which form most of the surface of the earth. Then, as the atmosphere cooled to about 1,000°C, water molecules in the form of steam began to condense from oxygen and hydrogen in the cooler, upper atmosphere and eventually precipitate as rain; but they would be gassified into steam as soon as the rain came in contact with the hot earth. There is also an accretion model, stating that the oceans were due mainly to watery comets crashing into the earth. As the comets are used up, the crashes become less frequent, but are still going on today.

In any case, there were convection currents set up between the hot, solidifying crust and the turbulent atmosphere which contained the elementary gases and the rapidly forming gaseous molecules such as H_2O, HCN, CO_2, CH_4, NH_3, etc. As the earth cooled these molecules stabilized and did not become so easily disassociated into their elements by the hot crust. The heavier molecules began to concentrate near the surface and to dissolve in the oceans which began to form once the crust had a temperature below 100°C. The lighter molecules of H_2 and He were lost to outer space. The oceans were much smaller than at present, as much of the water was still in the hot atmosphere. The heavy organic molecules and the isolated pools of water began to form into a concentrated soup about 25,000 years after the solidification of the earth.

Within the atmosphere the simpler organic molecules began to react under the influence of ultraviolet radiation and lightning to form more complex and heavier molecules, which would concentrate by sinking to the soup. The process was abetted by the catalytic action of inorganic clays. The oxygen molecules, highly reactive, were almost entirely incorporated into chemical compounds with other elements so that there was very little free oxygen and consequently no ozone, O_3, to shield the earth from ultraviolet radiation. The earth had a reducing atmosphere. Most of the surface would remain relatively unoxidized for hundreds of millions of years. These conditions can be repeated in the laboratory today.

If we simply put H_2O, O_2, C, and N in an environment approximating that of the primitive earth, we obtain the simple molecules CO_2, H_2, CH_4, NH_3 and HCN and, of course, some residual amounts of the original elements. We note that these molecules are gases at the temperature of the primitive earth, but that they are much heavier than H_2 and He. Therefore, they will be retained and concentrated by the earth while the H_2 and He are being lost. After the earth had cooled sufficiently, still more complex molecules would begin to form in the atmosphere from these simple molecules. If today we put these molecules into a container in which the conditions of the earth a few thousand years after its formation are duplicated, and pass

electrical discharges through it, equivalent to lightning, and bombard it with ultraviolet rays, equivalent to unshielded sunlight, then spontaneously we have the amino acids formed [527, 528].

Here we see another step in complexity of structure which occurs automatically by chemical laws under the conditions of the primitive earth. The amino acids are basic building blocks leading to the proteins determining the physical structure of all known living systems.

Chemical evolution can only go so far by the same process by which amino acids are created. Eventually molecules must become self-reproducing in order to sustain increasing complexity. This is the case because the extremely complex molecules represent unlikely and unstable events. The complex molecules will spontaneously decay into simpler molecules at room temperature unless some mechanism is making the reaction go in the other way. This process is what Darwin called "natural selection."

Natural Selection

Relatively simple molecules such as RNA have autocatalyzing properties. This means that these molecules serve as templates by means of which simpler molecules are induced to organize themselves into complementary replicas of the original molecule. Recent evidence indicates that the inorganic clays contribute to this process. This is not reproduction in the normal sense of the word since the original molecule has not split into two or more copies of itself but has merely caused the creation of complementary copies of itself. There must be at least two complementary copies. With RNA we have four complementary copies and a slight variant, uracil, which is used in T-RNA. However, once autocatalyzing molecules exist it is possible to begin the process of natural selection.

Given that there are several species of autocatalyzing molecules spontaneously created through deterministic chemical reactions, then those molecules which can most effectively catalyze copies of themselves will take up more of the supply of available simple molecules to make copies of themselves while the other molecules are eventually disassociated into their constituents, which in turn are catalyzed into copies by the more effective molecules before they themselves disassociate. Eventually any given environment will contain only one species of competitive autocatalyzing molecules—the most effective at catalyzing copies of itself—all the other species having become extinct. However, the molecules are themselves constantly changing.

Through random bombardments of energy by radioactive elements, volcanic action, lightning, ultraviolet light, meteors, etc., the self-catalyzing molecules are constantly having their chemical structure changed. Most of these random changes will cause the molecule to become

disassociated and less effective in catalyzing copies of itself, and those mutations will become extinct. However, very infrequently a change will increase the autocatalyzing efficacy of the molecule; this mutation will quickly replace all its brothers. Therefore, here we have an example of chemical evolution by natural selection. This type of chemical evolution has been very elegantly modeled by Manfred Eigen and his associates [217, 218, 219, 608].

Evolution by natural selection involves three essential factors—reproduction, mutation, and death. Death simply means a disorganization of an entity into its more elementary component parts, as happens with all complex molecules which become disorganized into simpler molecules. If there were no death, eventually all the chemical compounds necessary for forming new molecules would be tied up in the older molecules and no new molecules could form. If there were no mutation, there would be no change, and new, more effective molecules would not be formed. If there were no reproduction, then there would be no mechanism for giving advantage to one molecule over another and the relative proportion of different molecules would depend only on the probability of any molecule being formed from its constituent parts. Therefore, all three components must be present for the system to evolve by natural selection.

We note that evolution, by whatever means, involves simpler structures organizing into more complex structures. This process is highly predictable and determined strictly by the laws of physics and chemistry up to the existence of autocatalyzing molecules. Once autocatalyzing molecules come into being, then highly unpredictable random factors determined by quantum mechanical laws begin to operate. The causes and results of any mutation are uncertain. The mutations which increase the reproductive efficiency of any molecule may be among the least probable. It is somewhat like randomly jumbling the letters and symbols in a blueprint and reproducing a better design. Evolution by natural selection is therefore a process by which highly unlikely events consolidate themselves and outlive much more likely events. It represents a monotonic decrease in the entropy of a system.

Entropy

The concept of entropy was first proposed by Clausius in the nineteenth century to refer to a property of all closed systems by which they lose their capacity for performing useful work. Another way of saying the same thing is to say that they are gradually transformed into their most probable state. This latter statement of the concept of entropy was formulated by Boltzman. A third way to describe entropy is in terms of a decrease in the coherent information in a system. The greater the coherent information in a system, the lower its entropy. The more chaotic and disorganized a system,

the higher its entropy. This view was derived by Claude Shannon in the late 1940s and is mathematically equivalent to the other formulations of entropy. The most probable state for any system which evolves by natural selection is death, i.e., a disorganization of the system into its component parts. In the case of the autocatalyzing molecules this means a breakdown of those systems into the simpler compounds which compose them. Experimentally we observe that in a closed system, say a glass flask which has been exposed to high temperatures, most of the molecules will be in the disassociated state. All entities are exposed to random disruptive energy from earthquakes, solar bursts, cosmic rays, meteors, natural radioactivity, volcanos, and many other natural but not precisely predictable, i.e., random, events which disrupt them and increase their entropy.

The second law of thermodynamics states that the total entropy in any closed system can never decrease. Intuitively we can look at the concept of entropy as (1) the non-availability of energy in a system for doing useful work or (2) the total disorder and randomness of a system. Therefore, the second law of thermodynamics apparently states that evolution cannot occur in a closed system. Yet evolution is an objective, directly observable reality. Only the mechanisms by which evolution occurs are disputed.

Evolution refers to (1) the increase in the ability of a system to predict and control its total environment, i.e., to do useful work, (2) an increase in the complexity and order of a system, or (3) simply a decrease in the entropy of a system, sometimes expressed as an increase in negentropy. The autocatalyzing molecules clearly increase their capability to predict and control, which in their case is limited to producing progeny. In the process they increase their complexity and decrease their entropy, as is indicated in the studies by Manfred Eigen et al and by Lila Gatlin [281]. The concept of complexity is not usually treated precisely. For our purposes, we will regard the complexity of a system to be a direct function of (1) the total number of components of a system, (2) the number of different connections and relationships between the components, (3) the number of differences between all the components and connectors, and (4) all other information in the system. This is clearly a simplification of the concept of complexity.

The sun has approximately 10^{59} components, i.e. hydrogen atoms, but there are relatively few relations and connections between them in the form of helium and heavier elements. The largest living cells have no more than 10^{12} atoms. However, the connections between the atoms in the cell are much more numerous than in the sun, so that the cell seems much more complex than the sun. The information content of a cell may be greater than the sun's. By the time we come to a system of cells such as a human being, we have information and complexity greatly exceeding that of the sun. Therefore, if we consider the solar system as a closed system, although the entropy of the sun is clearly increasing, it is not clear that the entropy of the total solar system is increasing, because of the enormous increase

in complexity of the biomass in general and of the human species in particular.

If the second law of thermodynamics is to continue to hold, this means that the solar system is not closed, as indeed our section on cosmology indicates, but that organizing energy and, more importantly, information are being drawn from other parts of the universe and that this information is contributing to the evolutionary process. The nature of this extrasolar organizing information will be discussed later. For now we merely note that although natural selection may explain much of the evolutionary process it does not necessarily explain all of it. Darwinism in all its forms may be an incomplete description of the evolutionary process. We shall see that there is evidence that information can increase faster than physical entropy, although there is a one-to-one mathematical correspondence between the information theoretic and the thermodynamic concepts of entropy.

Given that a system has autocatalyzing properties—i.e., reproduction, mutation, and death—then evolution will proceed as long as there is an adequate supply of energy plus information and as long as the energy is not so disruptive as to produce an overwhelming rate of deleterious mutations or deaths. (See Lila Gatlin's work [281].)

A mutation is deleterious when it decreases the probability of the autocatalyzing system to reproduce itself, i.e., increases its entropy. The death rate becomes overwhelming if it exceeds the birth rate until the species undergoes extinction. Life and indeed chemical evolution cannot occur on the sun or the inner planets (Venus and Mercury) because the energy is too disruptive to allow complex molecules to form for a significant length of time. On the outer planets and their moons there may not be proper energy or appropriate conditions to push evolution against the force of entropy. As indicated earlier, Jupiter and possibly Mars may be exceptions [360]. Evolution by natural selection requires a very delicate balance in mutation rates, death rates, and reproduction rates, or it will not take place [245]. An essential condition also seems to be the existence of liquid water. Around any given star there is only a relatively narrow shell, "the ecosphere," within which the conditions for evolution are adequate and the balance is achieved. (Our sun's ecosphere extends from just inside the orbit of earth to just outside the orbit of Mars [400].) When this balance is achieved, then entropy is overcome step by step.

Jacob's Ladder

". . . and behold a ladder was set up on earth, and the top of it reached to heaven." (Genesis 28:12)

The counterentropic climb up the evolutionary ladder begins with the autocatalyzing molecules. Once the first such molecule was formed in at least

one complementary pair by unlikely but not impossible chance from the physicochemical forces prevalent in the primitive earth, it began to reproduce, mutate, and die. The overwhelming majority of the mutations would increase their entropy and leave fewer progeny, but for every few billion mutations, one was, again by unlikely but not impossible chance, decreasing its entropy and becoming more effective in organizing and concentrating simple molecules into copies of itself. Every time that this happened its descendants would replace the descendants of its less effective siblings and one more step would be taken up the ladder of evolution. The second law of thermodynamics was still operating but in such a way that the less efficient, more entropic autocatalyzing systems were becoming extinct while the more efficient, less entropic ones were multiplying. At the same time the conditions which produced the mutations and gave advantage to one molecule over another were themselves changing. Therefore, the ladder of evolution is one in which the lower rungs are continuously being disassembled and used to build the upper ones. It is possible to climb up, but one cannot climb down without falling off into irreversible entropy.

It is estimated that the sun is 60% hotter now than when the earth was first formed. However, as the organic molecules and the CO_2 in the earth's atmosphere became fixed in living forms and dissolved in the oceans, the greenhouse effect decreased, so that earth could maintain a steady temperature with a hotter sun. Amazingly, the ecology of the earth changes to maintain an almost steady temperature. There is clear evidence that the earth's temperature has been remarkably constant for the last four billion years. (See James Lovelock's work [935].)

In time, the autocatalyzing molecules which were most efficient at one stage could not survive or reproduce at another stage. Their elements had been used to create the next rung on the ladder of evolution which their progeny continued to climb. Eventually so many of the organic molecules essential to reproduction were tied up in the increasingly stable and efficient autocatalyzing molecules that a new type of reproduction became necessary.

So long as there were simple organic molecules, i.e., nutrients, plentiful in the environment, reproduction by catalyzing complementary copies through template action was an efficient form of reproduction. However, as the number of self-reproducing systems increased and the nutrient concentration decreased, this type of reproduction became increasingly difficult to perform, and it became necessary for the self-reproducing systems to concentrate nutrients. This was done by growth.

Although there may not be a sufficient concentration of nutrients at some particular point in space and time for an autocatalyzing molecule to reproduce itself, if it can absorb these nutrients and store them, then eventually it can have enough nutrients for two copies of itself. The way molecules can grow, almost without limit, is by polymerization. Therefore,

in a system which is evolving by natural selection, the autocatalyzing property is used by the molecule to extend itself at both ends in a single system which eventually splits into two and only two parts. Then these parts in turn extend themselves, split, and repeat the cycle. These systems which reproduce by polymerization growth and splitting are by and large less stable than the more simple autocatalyzing molecules. Therefore, they will have higher death and mutation rates. They are less likely to exist early in the evolutionary process in competition with the simpler autocatalyzing molecules. However, they have a much higher reproductive efficiency in an environment which is becoming dilute in nutrients. Today we know of two major types of molecules which have some of the properties of these early self-reproducing polymers; they are the proteins and the nucleic acids.

Proteins and Nucleic Acids

Proteins are polymers formed from amino acids, which, as we have seen, were spontaneously synthesized and concentrated in the conditions of the primitive earth. The proteins form fairly stable polymers and they are very effective catalysts. But they require more idealized conditions to reproduce copies of themselves than the nucleic acids and they have a lower mutation rate.

The nucleic acids tend to form relatively unstable polymers, but they are very efficient reproducers and easily mutable. The fact that proteins and nucleic acid polymers primarily use different nutrients means that they could coexist and evolve in parallel. They were noncompetitive. More importantly, it is possible for them to form symbiotic systems.

Symbiosis

Symbiosis is a process by which two distinct, self-reproducing systems organize into a compound system such that the net reproductive effectiveness for both is increased. An evolutionary process based solely on proteins or solely on nucleic acids is less thermodynamically effective than one based on the symbiosis of both proteins and nucleic acids, as is shown in the work of Manfred Eigen [217]. Therefore, it is likely that once chemical evolution by growth and splitting began it was soon based on symbiotic systems of proteins and nucleic acids.

These might have been formed by the spontaneous capture of nucleic acids within protein spheres. Many proteins in water spontaneously form into hollow spheres under conditions which probably existed on the early earth. Most of these spheres would have been nonviable. However, once the right proteins and the right nucleic acids formed, then a symbiotic process began. This is the closest point to the actual beginning of life. These processes would, in fact, have begun spontaneously if the right proteins and

nucleic acids came together in any given region. However, this would be highly unlikely because conditions for their synthesis are different. Once they began interacting symbiotically, their concentrations would increase, and there would be a higher probability of a protein sphere capturing the right nucleic acid and forming what amounted to a protocell. The symbiotic interaction of proteins and nucleic acids to create one another, and thereby to create life as an epiphenomenon, is known as "autopoiesis" (self-creation) [381], after Chilean scientists Varela and Maturana [796].

Protocells

In living cells the functions of the proteins and the nucleic acids are clearly divided. The nucleic acids are in charge of all information storage, transfer, and reproduction, while proteins are in charge of forming structures and catalyzing chemical reactions. The nucleic acids (RNA) are organized into DNA. The DNA molecules within each cell contain all the information for structuring each given living creature whether it be an amoeba or a human being. This division of function could not have survived under the pressure of natural selection if they were each evolving in isolation from one another. And, as we have seen, this isolated evolution might have preceded the symbiotic evolution. Therefore, these complex self-reproducing polymers, the protocells, which were the precursors of living cells, must have been quite different from existing proteins, DNA, or living cells.

We can imagine but not yet create a polymer which has properties of both proteins and nucleic acids. If such a molecule were subjected to natural selection, it would be more thermodynamically efficient for the functions of the nucleic acids and the proteins to differentiate. Therefore, it might be that the protocell was a generalized molecule with properties of both proteins and nucleic acids to start. Later this molecule became differentiated into a system of distinct molecules working symbiotically (complementary pairs) to become a living cell. However, for reasons to be given in Chapter 5, this does not seem to be the case. The entire pattern of the evolution of the universe seems to be based on autopoiesis between complementary pairs of entities such as protons and electrons, proteins and nucleic acids, or males and females. When this autopoietic interaction occurs then a whole new dimension is added to evolution. The new dimension that was added to matter by autopoiesis we call "life."

CHAPTER 2

The Evolution of Life

There is no clear dividing line in terms of its operational properties between the purely chemical system we have called "a protocell" and a living cell. Both metabolize, grow, mutate, reproduce, and die. Metabolism refers to the property by which a self-reproducing system absorbs nutrients and turns them into parts of itself and useful energy. The protocells may appear completely passive in that their functions are completely determined by chemical laws, while cells, such as an amoeba, seem to act purposefully to seek out nutrients and metabolize them. However, arguments can be made that the apparent purposefulness of the amoeba in capturing and digesting nutrients is completely determined by physicochemical laws and its own physicochemical structure. Plants, which are much more evolved than amoebas, seem as physicochemically determined and passive as the protocells. Therefore, there may be no true or meaningful dividing line between matter and life. Both are manifestations of a single evolutionary process. But life seems to make choices while matter does not. More will be said of this in Chapter 5. First we will consider the more deterministic patterns of evolution.

The Pattern of Evolution (Preview)

Tracing the evolutionary process from the earliest beginnings currently perceivable to the present, we see the following pattern emerge. Chaotic energy organizes into elementary particles; these organize into systems of particles (nucleons); the nucleons organize into systems of nucleons (atoms); the single atoms organize into large but simply connected systems of atoms (galaxies, stars and planets); within the stars more complex atoms are built from simpler atoms; within the planets, and to a lesser extent outside the planets, atoms organize into small but complexly connected systems of atoms (molecules); the molecules organize into increasingly complex systems of molecules until these systems are self-replicating; then evolution by natural selection begins and leads to symbiotic systems of self-replicat-

ing molecules (the protocells) which through autopoiesis become first bacteria; then the bacteria organize into nucleated cells. We shall later show how this pattern is continued with cells organizing into autopoietic systems of cells (i.e., multicellular animals—the metazoa) and how these systems become increasingly complex until they are capable of consciously directing their own evolution through higher-order autopoiesis. These latter systems (human beings) then organize into complex interdependent symbiotic, but not yet autopoietic, societies.

We note the following pattern:

(1) Each system incorporates all the properties and information of its subsystems plus some new properties and information of its own; the latter are epiphenomena of the new higher-order autopoiesis.

(2) Higher systems cannot exist without lower systems.

(3) The basic systems are composed of a central organizing nucleus with simpler interdependent subsystems in the periphery, e.g., atoms, galaxies, solar systems, cells and their nuclei, humans and the brain, human societies and their central governments.

(4) Each time a new level of organization (autopoiesis) evolves, there occurs a new dimension of complexity, to be called dimensional quadrature (e.g.: nucleons becoming atoms, atoms becoming molecules, molecules becoming bacteria, bacteria becoming nucleated cells, cells becoming metazoa, metazoa becoming human).

(5) As we will show later, this is a process which may have no end.

(6) A common denominator is ever-increasing complexity and total coherent information content, which enables each system to use all its subsystems and related systems to synthesize ever more complex supersystems with ever more coherent information.

The Cellular Synthesis

The developmental steps leading from the first protocell to the final cell may have been as great as the steps leading from atom to protocell. The major steps in cellular development involved (1) the evolution of RNA, protein, and DNA within the cell, (2) the specialization of proteins into enzymes, cytoplasm, and the related subsystems, (3) the formation of a protective semipermeable membrane, (4) the development of a central nucleus as bacteria evolved into cells, and (5) directed locomotion.

It is almost certain that through natural selection a symbiotic interdependency developed between the nucleic acid and protein of the protocell until neither one of these components could survive without the other—the beginning of autopoiesis. The point at which autopoiesis came into being is the closest approximation to the point at which life as we know it

started, although this is clearly somewhat arbitrary. The protocells would eventually replace all the autocatalyzing molecules, possibly by metabolizing them, and then begin competing against one another. Those protocells best able to assimilate nutrients and reproduce would replace the less efficient protocells, i.e., those that were not autopoietic. The evolutionary pressure was on increasing the capability for (1) obtaining nutrients and (2) reproducing. Those protocells which first developed the capability for movement had a distinct advantage in obtaining nutrients over the protocells which were dependent on currents of water for moving them to places where there were nutrients. If these protocells ever became stagnated in nutrient-poor pools, they would die out. Eventually protocells with the capability of movement predominated.

Movement could at first have been due to vibrations sent up in the outer parts of the protocell by the absence of nutrients. Some of the proteins would have mutated into vibratory molecules which had their vibrations damped by nutrients so that the protocells would always move in the direction of maximum nutrient concentration. The cilia are proteins, which have this property and will behave in this way independently of the rest of the cell. This gives the appearance of purposive action to a completely automatic chemical process. However, the information within the cell also modulates the cilia.

"Evolutionary pressure" refers to the propensity of natural selection to favor some mutations over others because of the current environmental opportunities that exist for those mutations. It is a pressure that pulls from the future rather than pushes from the past. Once the evolutionary pressure through natural selection was pulling the protocell toward symbiotic development, mutations which favored one subsystem of the protocell at the expense of another would not survive. Movement favored the entire protocell. However, increased efficiency in metabolism of nutrients in only one part (say, the outer covering) of the protocell would lead to asymmetric and deleterious growth. Therefore, fairly early in the evolution of the protocell a subsystem had to be developed for distributing nutrients to all parts of the protocells in a balanced way. This might have occurred at first by having a circulating homogeneous mixture of nutrients so that the nutrients were equally divided among all parts of the protocell. Eventually it was to be done through special metabolic pathways by specialized molecules through the process called photosynthesis.

Photosynthesis

The protocells probably required fairly complex molecules such as amino acids and nucleotides for nutrients. As the protocells evolved, these nutrients, which were probably contained mainly in the structures of the older autocatalyzing molecules, became increasingly scarce. The only readily

available molecules then were relatively simple ones such as HCN, NH_3, CH_4 and CO_2. The latter had now become a major constituent of the atmosphere and was probably a metabolic product of some of the early protocells. We recall that the building of complex molecules from simple molecules requires an input of energy. As the earth evolved there was ever less energy for this purpose except from sunlight, where the energy may have been increasing. But the sunlight is very diffused over the entire surface of the earth and it could not readily provide, except in the upper atmosphere from solar flares, those bursts of energy which are necessary to pull the simple molecules up the evolutionary ladder. These bursts probably continued to come from lightning, volcanic action, cosmic rays, meteors, background radiation, and the like impinging on concentrated pools of molecules. These events may still occur in the suboceanic volcanic vents. However, there is a fairly simple physicochemical process called photosynthesis for concentrating solar energy. The photosynthetic process has no survival value by itself but only when it is incorporated as part of a self-replicating system. Only a highly evolved protocell or clearly living cell would be likely to have the complex subsystems to support and utilize photosynthesis. However, once photosynthesis began, there was a literal explosion of life.

At this time, the atmosphere and the oceans were loaded with CO_2 and there was very little free oxygen. Some oxygen had probably been produced from early times by the disassociation of water in the upper atmosphere as follows: $3H_2O$ + photon $\rightarrow$ $3H_2 + O_3$. The H_2 escapes to outer space. This is probably how Mars, with much less gravity than earth, became depleted of water. The ozone forms a protective cover against high-energy ultraviolet rays and breaks down into oxygen: $2O_3 \rightarrow 3O_2$. Once a series of mutations began to give the protocell the capability for synthesizing nutrients from simple molecules and sunlight, it had an enormous advantage over its less chemically sophisticated relatives. Its progeny would expand and fill the entire biosphere. All non-photosynthetic protocells would tend to become extinct. Almost all life on earth is descended from these early photosynthetic cells. Animals are, in essence, mutated plants. Many of the anaerobic bacteria, which die in the presence of oxygen, are the direct descendants of the prephotosynthetic cells. They survived in small out-of-the-way niches which still exist today.

The Animal Mutation

The photosynthetic cells, once formed, must have quickly covered the surface of the entire ocean. In the process they began to absorb all the CO_2 in the oceans. As this CO_2 was absorbed, more of the atmospheric CO_2 was dissolved in the ocean, and the total concentration of free CO_2 began to decrease. At the same time there was a cooling of the earth from a quickly decreased greenhouse effect. But the sun was probably getting hotter.

Simultaneously the photosynthetic cells were releasing oxygen into the oceans and the atmosphere. At first the oxygen was absorbed by the reduced minerals, particularly iron. The earth first had to rust before it had an oxygen-rich atmosphere. Eventually the atmospheric concentration of CO_2 was so low and the concentration of oxygen and photosynthetic cells so high that these cells began to die, choking on their own wastes and starving from a lack of nutrients. Somewhere about this time, one to two billion years ago, occurred the mutation which was to lead to humanity.

The primitive photosynthetic cells still exist in the form of blue-green algae. Fossils (stomalites) produced by blue-green algae 3.5 billion years ago in Australia were discovered in 1986. The green and red algae represent more highly evolved photosynthetic cells. Cells with properties of both photosynthesis and animals occur among the bacteria. Sometime after nutrients became scarce for the photosynthetic cells it became advantageous for some cells to metabolize the bodies of their dead relatives. This was an added ability which enabled them to profit from the deaths of the purely photosynthetic cells. Eventually these cells became highly mobile, like the amoeba, and they began to prey on the living algae. Once this started, since there was an enormous excess of algae, there was an advantage in changing their metabolism to strict oxidation of the bodies of algae and in stopping photosynthesis: i.e., they began biosynthesis. In the process these cells became oxygen breathers and lost their photosynthetic capability. Eventually a balance was established in which some cells metabolized through photosynthesis, some metabolized through biosynthesis, i.e., the oxidation of other cells, and some had properties of both. The former became plants, the latter became various types of bacteria and fungi, and those in between became animals. We define as "bacteria" all free living cells without a nucleus. Geneticist Lynn Margulis, although she did not use the term "autopoiesis," developed the now widely accepted theory that nucleated cells developed from autopoiesis within colonies of bacteria.

If there was a proliferation of plants, it would soon be counterbalanced by a proliferation of animals which would metabolize the plants and their by-products. If then the concentration of plants fell too low, there would be mass starvation among the animals, who had lost their capability for photosynthesis, and this would lead to a new proliferation of plants. The photosynthetic bacteria as well as the old anaerobic bacteria served as a buffering agent between the two newer life forms. However, the evolutionary pressure was such that the long-term advantage belonged to the animal cells and not to the algae or bacteria.

Sexual Reproduction

All the early cells reproduced asexually through binary fission in a process analogous to the splitting of the protocells. In binary fission (mitosis) the DNA inside a cell replicates itself, the two copies then segregate themselves

at separate poles of the cells, then the cell splits into two identical copies. In sexual reproduction (meiosis), two different cells share their DNA and combine into new patterns after splitting into two haploid cells, each with half the DNA of the original. Each cell gives half of its DNA to the other and becomes a unique combination afterward which splits by mitosis.

Within the cell the DNA usually is not a single, paired molecular strand except in the most primitive cells and viruses. (We note that some viruses are based on RNA and not DNA.) Instead the DNA is organized into discrete, complementary paired packages called chromosomes. Each chromosome pair is somewhat like a book of redundant one-line instructions divided down the middle. Each half is necessary to complete the full message for each line. Although sterile haploid females can be produced from an unfertilized ovum among the lower species, no one has done this for the higher animals. In sexual reproduction each cell divides the books of its chromosome pairs in two and exchanges halves with another cell. If both cells were identical, the sexual reproduction would be no different from the asexual reproduction in its effects. However, no two cells are ever absolutely identical, since they each have had some mutations which would alter their DNA blueprint in different ways. Each mutation represents some change in one of the one-line instructions. Males also have one chromosome which is uniquely male; they share all their other chromosomes with females. Therefore, when the two halves of the different cells are recombined, they will form a completely new set of instructions in some lines and lead to a unique new individual.

Sexual reproduction has the *de facto* effect of increasing the mutation rate without significantly increasing the rate of deleterious mutations, since what is being done is combining two different sets of viable instructions into a new pattern. It so happens that some instructions which are evolutionary by themselves are entropic when combined. Rh-factor disease in humans is an example of this; so sometimes hybrids are inferior to either parent. But often the hybrids combine the best features of both parents and are superior to either parent. This phenomenon is referred to as "hybrid vigor."

The life function that any instruction controls is determined by its position on the chromosome, i.e., its position on a particular page of the book. The set of all chromosomes is the library of instruction manuals for regulating the biological processes of all living creatures. Each library is unique to each species and cannot recombine with the library of another species except through radical laboratory procedures involving recombinant DNA that produce interspecies hybrids called "genetic mosaics" [584]. Species differentiation occurs when two groups of the same species are isolated from one another so that they cannot interbreed and therefore undergo different mutations; their libraries, that is, their chromosomes, become so different that they can no longer recombine at random,

because too many nonviable combinations occur or they are chemically incompatible.

In evolution there is a progression of integration by twos: (1) Some nucleic acids and proteins integrate into symbiotic systems of nucleic acids and proteins (the protocells); (2) some nucleic acids integrate into a symbiotic system of two-stranded DNA (primitive cells); (3) some DNA integrates into a system of paired packets of DNA, the chromosomes (advanced cells); (4) some species integrate into complementary pairs called "sexes." An extrapolation of this process is given later by which evolutionary hierarchies by systems of four complementary pairs are shown to exist at all levels, from atoms to super-human societies.

All the higher, i.e., least entropic, species reproduce by sexual means. Even some primitive bacteria exchange genetic material within their colonies, although this is not done in as obvious and seemingly purposeful a way as in the paramecium. Through sex the potential variability of a species is given its maximum expression, and the progress of natural selection works more effectively. Each individual in a sexual species must not only find nutrients and go through the physical motions of reproduction, it must also find and compete for a mate. The competition for and selection of mates is an important part of natural selection for all the higher animals, particularly humans, as Darwin first eloquently noted [97, 173, 245]. However, before discussing natural selection among humans, we will examine how it has functioned in all the animal species that led to humanity.

For now we note that each individual in a sexual species is far more different from its siblings than individuals in a nonsexual species. Indeed, the probability of the same parents producing genetically identical twins from two distinct sets of ova and sperm is less than 10^{-100} [744], which is close to impossible! This is why we are all unique. Identical twins come from a single, split embryo, not two separate genetic combinations. The higher degree of useful differentiation which occurs in a sexual species tends to produce more generalized capability within the species as a whole for predicting and controlling the total environment. Each individual represents a unique combination of properties which can serve as a base for one more step up the evolutionary ladder.

Animal Evolution

The evolution of animals is of central concern in studying the evolution of humans because humans evolved from simpler animals and all animals evolved from the protozoa. However, the evolution of animal life is inextricably interwoven with the evolution of plant life. The plants are our partners in evolution—our complementary pairs in the biosphere.

The protozoa consist of all single-celled organisms which have no photosynthetic capability and depend on consuming products or entire

cells of living organisms. The fossil evidence about the evolution of the protozoa is meager because in general they have no hard parts and leave no fossils. Certain bacteria secrete unique organic compounds. Deposits of these compounds have been found in rocks over 3.8 billion years old. Therefore we have evidence that the bacteria are about four billion years old. The protozoa evolved after the earth had an oxygen-rich atmosphere, about one-to-two billion years ago. The early protozoa were probably all plant eaters. As the protozoa expanded and plant food became scarcer, some protozoa began to prey on one another.

This is speculation, but remember many essential facts are missing. We are constantly speculating to complete the evolutionary picture, which itself evolves by trial and error. Everything in this book may be in error including all the "hard scientific facts."

Predation on one another by protozoa established a new balance in nature in which there were now four higher types of life forms: (1) plants, i.e., algae, (2) plant-eating protozoa, (3) protozoa-eating protozoa, and (4) various combinations of the first three. The fact that protozoa began to prey on the more active animal cells caused evolutionary pressure to favor mutations which enhanced defensive mechanisms among the prey cells and more effective sensory and mobility mechanisms among the predator cells. Some prey cells concentrated inorganic salts into a protective shell, e.g., foramenifera and radiolaria, and this produced the first true microfossils of about 2 billion years ago. The famous white cliffs of Dover were produced by these microorganisms, as were many other geological features such as the Mesabi iron deposits in Minnesota.

Another method for protecting themselves from predators was for the protozoa to organize into colonies which were too large for an individual predator to ingest. Some of the earliest microfossils, from 1.5 billion years ago, are of these colonial protozoa. Once an evolutionary advantage was established to colony formation, then the individual protozoa, under pressure of natural selection, began to organize themselves into ever larger and more complex interdependent societies which were to evolve into multicellular animals—the metazoa.

The Metazoa

We are very fortunate in being able to witness a living example by which separate, individual cells organize themselves into a complex interdependent colony. This occurs in bacterial colonies and the slime molds, which are formed by amoebalike creatures which combine features of protozoa and fungi [697].

The slime mold single cells live as independent amoeboid predators similarly to the regular amoeba. When some of the individual cells are ready to reproduce they secrete a chemical substance called "arcasin."

This serves as a chemical attractant and stimulant to other individual cells which migrate toward the secreting cell and in turn secrete more arcasin, thereby attracting and stimulating other cells until a colonial mass of many thousand cells exists. This mass then functions as a single individual and crawls wormlike toward a suitable nesting site where it roots, grows a stalk, develops spores and casts them out to become new individual amoeboid predators which will repeat the cycle again when the conditions are right.

A much more dramatic example of metazoan evolution is contained in human embryology. Since all animals have evolved from single cells by a series of mutations in the basic DNA molecules, and many changes in the DNA molecule become part of the permanent record, the embryological development of a human or any other animal should mirror the entire evolutionary history of its species from a single cell. This is indeed the case at the embryological, not at the adult, level.

The fossil history derived from paleontological findings confirms the embryological evidence that the basic progression went from single cells to cell colonies, to interdependent systems of differentiated cells, to wormlike animals, to fish, to amphibians, to reptiles, to primitive opossumlike mammals, to generalized placental mammals, to tree-dwelling primates, to ground-dwelling primates, to successively more advanced types of hominids. The hominids are all upright-walking primates, which broke off from a common ancestor to both the chimpanzees and humans about five million years ago.

From the beginning of the earth until about 4 billion years ago, there is no fossil evidence, since this was the time of chemical evolution. From about 4 billion to about 2 billion years ago there were no higher life forms than photosynthetic cells. From 2 billion years ago, there is no evidence of any life higher than one-celled protozoa until one billion years ago. From 1 billion to 500 million years ago, there are nothing but growing quantities of invertebrate fossils: sponges, jellyfish, worms, mollusks, trilobites, echinoderms, sea scorpions, etc. With the possible exception of some worms, none of these life forms are in the ancestry of humans. From 500 million to 325 million years ago we see no higher vertebrate than the fish. From 325 million to 280 million years ago, the highest vertebrates are represented by the amphibians, then the reptiles appear and represent the dominant form of land life for over 200 million years. During this period the mammals appear, evolving from early mammallike reptiles about 200 million years ago. The birds split off from the reptiles at about the same time. It takes mammals over a hundred million years to replace the reptiles as the dominant form of land life after the mass extinction of the dinosaurs 65 million years ago. The mammals reach their maximum diversity and numbers about 20 million years ago and then begin to undergo a gradual decline in number of species. At about the same time, the primate line that is to lead to humans, the Hominoidea, begins to diversify and proliferate. From the

fossil evidence, humanlike apes appear about 18 million years ago, e.g., Sivapithecus and Ramapithecus. Apelike hominids appear about 4 to 5 million years ago. Our fully human ancestors, indistinguishable in any important biological feature from us, appear about 100,000 years ago in Africa and the Middle East. Extensive fossils have been found only from about 50,000 years ago, in Europe. In the last 100,000 years *Homo sapiens* has become the clearly dominant form of animal life and threatens, like all other previous radical mutations, to outbreed its food supply.

The Myth of Ecological Balance

The history of evolution is the history of succeeding ecological catastrophes. The survival value of photosynthesis occurred after the first cells had just about exhausted their food supply and were facing mass starvation. The mutation which led to animal cells occurred after the algae had just about exhausted their food supply and were facing mass starvation. The individual prey cells mutated into metazoa when the more specialized predator animal cells began to put evolutionary pressure on the more generalized omniverous prey cells by consuming them in ever greater numbers and threatening them with extinction. Once the simple metazoa came into being, some of them in turn mutated into predators that preyed on other metazoa and the larger single cells. This established a new ecological cycle in nature. The existence of metazoa created a new ecological niche for the algae, bacteria, and protozoa in which they could exist as parasites on the larger, more evolved life forms. The one-celled life forms had in turn been hosts to a special type of parasite called a "virus."

A virus is a degenerate form of life which has lost the capacity to reproduce except within the living cell of a host. It has regressed toward the protocell stage and below. Contrary to some theories, viruses are probably not the ancestors of cells but are instead mutated degenerate descendants of cells or protocells which can only exist as parasites and are not independently self-replicating. A parasite is a life form which has higher entropy than its ancestors and can only live at the expense of a life form which has lower entropy. As we shall see, the induction of parasitism is an ecological imbalance which is an intrinsic part of the evolutionary process and occurs even among the highest species, the humans.

It is the very imbalances in the ecological system which provide new opportunities for evolving life forms. The appearance of land plants about 400 million years ago created an ecological imbalance which made it possible for land animals to evolve from the fish and arthropods. The early amphibians created an ecological imbalance by filling a new ecological niche and were almost all quickly replaced by their descendants, the reptiles. Of the wide variety of amphibian life which flourished 250 million years ago, only the frogs, newts, and the salamanders survive. The reptiles

flourished for almost 200 million years and with catastrophic suddenness began to die out.

There is considerable evidence that approximately every 26 million years there are catastrophes of cosmic origin, e.g., collisions with comets, which wipe out many of the specialized species and open new niches for the most intelligent generalized species. One of these catastrophes apparently occurred 65 million years ago when the dinosaurs were wiped out and replaced by the mammals. Those periodic catastrophes appear to be due to a swarm of comets which intercept the orbit of the earth every 26 million years. There is a danger of the entire earth being destroyed at each interception if several very large comets hit it in quick succession.

Today the ecological imbalances that humanity is creating are primarily the effects of switching food supplies from serving the reproductive purposes of other animals to serving the purpose of providing for ever more human beings. The percentage of the total biomass taken up by any species is a biological measure of its evolutionary success. However, it is theoretically possible to destroy the basic cycle of life through pollution and other means [280]. It also appears that the human species produces at least as many parasites as it produces hosts for them. This is entropic.

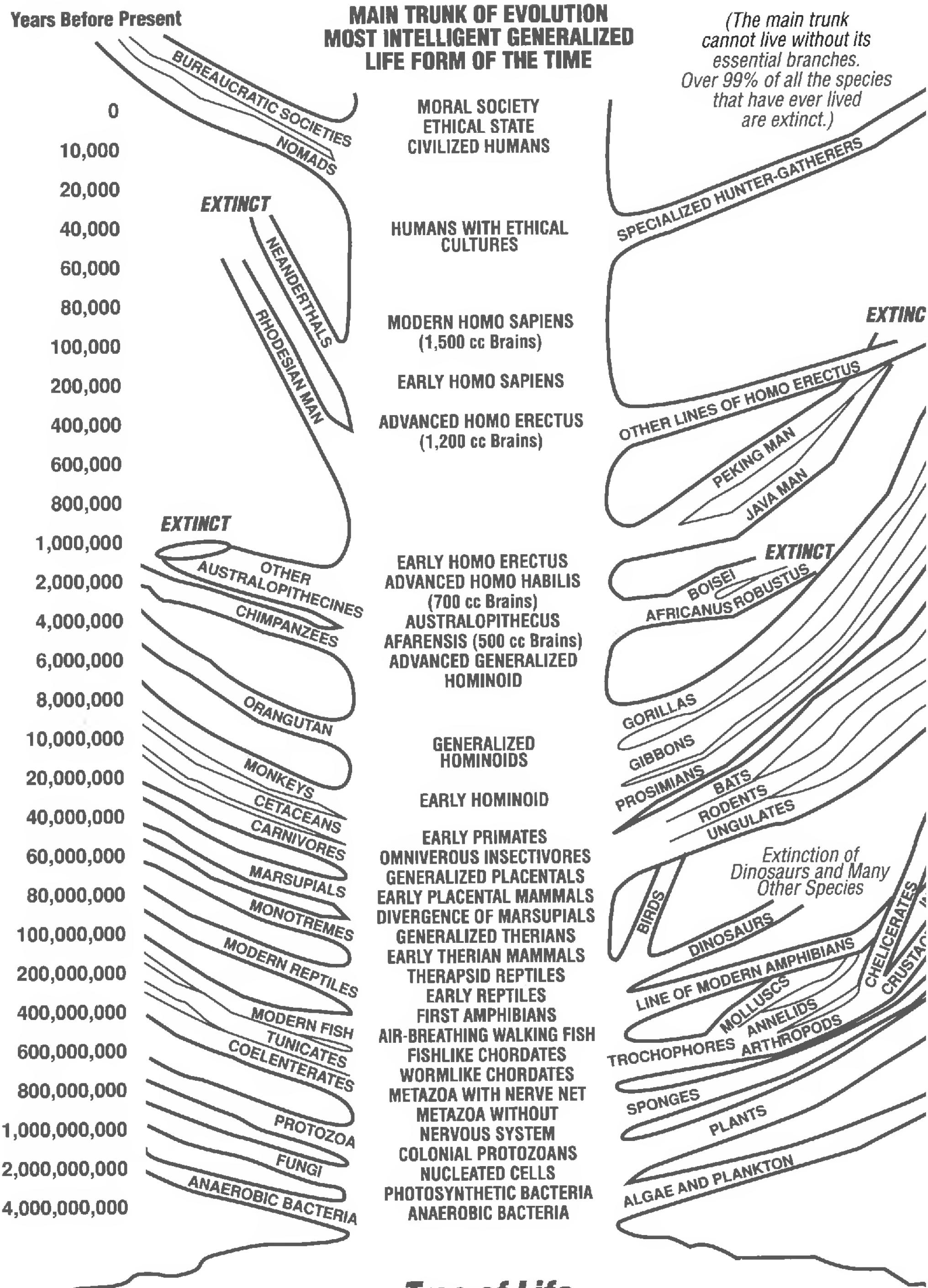
It is usually sentimentality that makes some environmentalists decry the extinction of tigers, wolves, and other large predators which have almost nothing to contribute to human evolution and are incapable of competing with the prime predator, *Homo sapiens*. But it is legitimate to decry the total sterilization of large parts of the ocean or destruction of the ozone layer and more through pollution [280]. We note that the trend in human evolution seems to be to domesticate all life forms, including ourselves, which serve human purpose, and to replace the rest. If ecological balance could ever be achieved, it would probably mean the end of evolution.

The Tree of Life

The Tree of Life, illustrated on the facing page, represents the approximate kinship of the various life forms and shows their departure from the main trunk of evolution as a function of time. Traditionally humanity has been shown at the top of the evolutionary tree. This was done more for emotional, egocentric reasons than for any more fundamental underlying criterion. However, we will show that this is where humanity belongs.

A common criterion which has been used by some evolutionists as determining the level of evolution of a given life form is its degree of change from a more primitive ancestor. By this criterion, elephants may appear more evolved than humans, in terms of their exterior morphology, if we trace the degree of change from a common ancestor. Intuitively, we feel that this may be wrong.

Change by itself does not determine evolution, since a change may



Tree of Life
With Some of Its Main Branches

increase entropy. This is obvious in the entropic decay of parasites which are very different from their ancestors. We defined an evolutionary improvement as a change which decreases entropy and increases the complexity of the organism. But it is not obvious that a human is more complex than an elephant. An elephant has a larger body and a larger brain than a human. Still we may intuitively feel that the elephant is less complex than a human.

Without getting into neuroanatomy, we can say that although the elephant brain may be larger than a human's, it has a simpler structure and therefore is a simpler brain. This is immediately obvious in terms of the behavior of elephants, which can in no way approach the complexity of human behavior. Since behavior is well known to be regulated by the brain, we must assume that the human brain must be more complex than the elephant's.

In discussing the evolution of humanity's immediate ancestors, we will go into more detail about the relative importance of various brain subsystems; for now we merely assume that there is a one-to-one correspondence between complexity of brain and complexity of behavior. In general, larger brains are more complex than smaller brains, but not always, since a large part of the brain may be used for controlling the vegetative routine functions of the animal. If we consider brain size in relationship to body weight, we get the relationships shown in the following table:

Ratio of Brain Weight to Body Weight in Selected Animals (adapted from Tobias [777])

Mammals	Ratio
Squirrel monkey *(Saimiri sciutea)*	1 : 12
Tamarin *(Leontocebus)*	1 : 19
Porpoise (Dolphin) *(Phocaena communis)*	1 : 38
House mouse *(Mus musculus)*	1 : 40
Tree shrew *(Tupaia javanica)*	1 : 40
Man *(Homo sapiens)*	1 : 45
Ground shrew *(Sorex minutus)*	1 : 50
Monkey *(Macaca mulatta)*	1 : 170
Gorilla *(Gorilla gorilla)*	1 : 200
Elephant *(Elephas indicus)*	1 : 600
Sperm whale *(Physeter catodon)*	1 : 10,000
Reptiles	
Crocodile	1 : 5,000
Stegosaurus	1 : 30,000
Brontosaurus (Apatosaurus)	1 : 100,000

We note that humans are considerably better off than elephants but not better off than a mouse [777]. This is explained by the fact that complex interactive behavior, e.g., learning abilities, is controlled primarily by the neocortex and not by the rest of the brain, which controls the vegetative and automatic responses of the body such as the metabolic cycles and emotions. If we plot complexity of behavior as a function of the fraction of brain weight which is taken up by the cortex, then we see the type of direct correspondence that we would intuitively expect (see page 128).

For the time being, we will assume that (1) the major direction of evolution is toward the development of ever more complex behavior as a means of increasing reproductive effectiveness; (2) complexity of behavior is in one-to-one correspondence with the complexity of the nervous system; and (3) a rough approximation to the complexity of the nervous system can be made by multiplying the fraction of the nervous system taken up by the cortex against the mass of the nervous system to determine "excess" neurons, as a crude surrogate measure of this complexity. From a different perspective we can say that the brain is a self-organizing, biological computer. The cortical parts, particularly the neocortex, are a general-purpose computer which are easily programmable and above all self-organizing.

As we shall later see, reality is actually much more complex than this. But this gives us a first crude approximation for discussing the direction of evolution and the meaning of the tree of life.

Direction and Meaning

If we again consider the Tree of Life on page 81, we see that it is continuously sending out branches from the main trunk. These branches in turn put out many twigs, but eventually stop growing and often die. Only the main trunk continues to grow upward. Once any life form branches off from the main trunk, it only moves ever further away from the trunk and it never rejoins it. Eventually all branches must stop growing, i.e., all species which branch out will eventually become extinct and leave no progeny.

The major differences between the species which are along the main trunk and those which are along the branches is that the former are generalized while the latter are specialized.

A generalized species is one which may obtain nutrients from many different sources and which may survive in many different environments, although it is less efficient in doing so in any particular environment than a "specialist" in that environment. A specialized species is one which may obtain nutrients very efficiently from only a few sources, but can survive only in a narrow range of environments. When a species specializes it is on its way to extinction because even slight perturbations in its food supply or environment can cause all its members to die out. The periodic extinctions of every 26 million years keep eliminating the specialized spe-

cies, making more room for the most intelligent generalized species. This is equivalent to a "pruning" of the tree of life. Remember, this is speculation.

Once evolutionary pressure begins to pull a species toward specialization, it can only become ever more specialized along the direction it has chosen. Through mutations it gains characteristics which enhance the specialization and eventually loses characteristics which are no longer relevant. Mutations driving the species backward toward the trunk are less likely to occur and are less likely to survive than mutations driving it out toward the end of the branch. Therefore, the species begins to become a closed system existing within an ever narrower environmental pattern until entropy destroys it.

It should be noted that under natural selection specialization is inevitable. If there are ecological niches which specialized species can fill, they will mutate from a more generalized species until these niches are filled. The higher any species is on the evolutionary ladder when it begins to specialize, the more effective it will be within each specialized niche. However, a generalized species does not begin to compete for a specialized niche unless it is vacant. This is what happened when the specialized dinosaurs suddenly became extinct about 65 million years ago. The generalized mammals and some birds specialized and filled all these niches within 26 million years. Then they too began to undergo extinction. The generalized species are usually at a temporary disadvantage relative to some more specialized species; therefore they are usually relatively small in biomass at a particular point in time, but they are larger in biomass over a long period of time. An example of this is the opossum, a small, highly generalized, primitive mammal which can exist in a wide variety of environments. The opossum, although never great in total biological mass if compared to other more specialized animals, has existed in its present form for millions of years. Furthermore, the opossum is less complex than many placental mammals, such as the horse, which underwent extinction in the environment it shared with the opossum.

Therefore, although the direction of evolution is toward ever greater complexity, complexity by itself does not assure survival and almost certainly guarantees extinction if it is a specialized complexity. The direction of evolution is toward ever greater generalized complexity. The lesson of evolution is that specialization leads only to extinction. Generalization is a necessary but not a sufficient condition for a species to continue its climb up the evolutionary ladder.

The Top Rung

At any given time the top rung of the evolutionary ladder is occupied by the most complex generalized class of animals. About 65 million years ago this rung was occupied by the mammals. As the mammals began to specialize,

to fill the niches of the extinct dinosaurs, although they increased their complexity for a while, they eventually climbed down the ladder, increased their entropy and many fell off, i.e., became extinct. About 40 million years ago the top rung was occupied only by a single generalized group, the primates.

The primates were highly generalized in the beginning and probably had an appearance very similar to today's tree shrew. Like all generalized groups, the primates began to shoot off specialized branches. The early primates were probably equally adept at living in trees or on the ground, but were not outstanding in any one of these modes of life. They all were omniverous and had grasping hands and feet which they used to good advantage for getting food and tree climbing. As the primates began to specialize about 40 million years ago, they began to emphasize one way of life over another—land dwelling or tree dwelling. In the process they began to become more specialized.

For living on the ground there is considerable advantage to running on all fours. Therefore, one family of primates became mostly quadripedal, as are the baboons and mandrils. For living in the trees there is considerable advantage to having long powerful arms for swinging from branch to branch (brachiating); therefore, another family of primates became mostly arboreal with long powerful arms and light body, as are the various groups of monkeys (rhesus, macaques, capuchin, etc.). Another group remained generalized in between, not fitting into any of the environments as well as its more specialized cousins. This group is represented today in varying degrees by the anthropoid apes, also called "hominoidea," e.g., gibbons, orangutans, gorillas, chimpanzees, and humans. They began to differentiate from other primates about 20 million years ago.

For millions of years the hominoids made up a very small percentage of the primate biomass because they could not compete effectively against their more specialized cousins. This is shown by the paucity of hominoid fossils, which are very scarce up to about 5 million years ago. (Part of the problem is that tree-living species rarely became fossilized.) But as we have seen, the evolutionary future belonged to the hominoids because once the other primates had specialized only the hominoids occupied the top rung of the evolutionary ladder.

Hominoid Evolution

Some of the hominoids continued along the main trunk of evolution up to the present time. About 18 million years ago a series of mutations occurred which enabled one group to become primarily land dwellers without becoming less generalized. This was made possible by substituting some partial, bipedal ground-running capability for tree-climbing ability and by acquiring at the same time a new capability of better use of the hands while

in motion. The net effect was probably a slight increase in overall general capability. At first this probably gave little or no advantage to these animals, some of whom were to be our ancestors, but what it did was open a new ecological niche for the primates—the niche of a machine-using species.

Machine Building

Many species have been and still are machine builders. For example, wasps, ants, and bees build complex nests which represent a community machine. Beavers build complex systems of ecological control with their dams, canals, and partially submerged houses—minor Venices. Beavers must gather branches, make mortar, dig canals, cut down trees, and arrange everything in a special order at the right places and keep all their machines in constant repair.

A machine is a manufactured device which transforms one form of energy into another. Tools, language, and social organization are all examples of machines. A machine decreases entropy for an animal which properly uses it by increasing the amount of useful energy at its disposal. A machine-using animal can, as a consequence, enhance its ability to acquire nutrients and reproduce beyond those abilities of a comparable animal which does not have a machine to use.

Many animals build and use machines. The capability for doing this, i.e., the blueprint for the machine and the operating manual, is transmitted by the genes and structured into the nervous system. The blueprint is "hard-wired." This is clearly shown in experiments which demonstrate that the nest-building capabilities of insects, birds, and to a lesser extent beavers are not learned but are a product of inherited instinct [470]. The machines of insects and birds have remained the same for many millions of years [93]. They have never acquired the capability to build any machines other than nests. The instinct for machine building is highly specialized and not generalized.

The beavers, on the other hand, have shown some changes in their nest structure over the last few million years. Their machine-building capabilities are only partially instinctive (hard-wired), although this is the main part. The noninstinctive part, which is more generalized (soft-wired), enables them to make slight variations in design. This is a result of the fact that they have much more complex nervous systems than both insects and birds. However, the beavers are already highly specialized for an amphibious way of life and their bodies are adapted to building only a special type of machine—an ecological community. They do not really create new machines but only make slight variations on an existing model which they carry in their genes. Our hominoid ancestors were different.

The early generalized hominoids, which had slightly better bipedal capabilities than their more arboreal cousins, had no instincts for building

machines. These hominoids, which are called "hominids," only had the advantage of being able to have their hands free while walking on the ground. They were not particularly good runners, compared to the baboons, for example, or as good climbers as their immediate cousins, the pongids, who were to evolve into the orangutan, gorilla, and chimpanzee. If they had not made maximum use of their hands almost from the beginning, they probably would have become extinct. The mutation for bipedal walking would have had no net survival value by itself.

The current chimpanzees can create machines, albeit very simple ones, independently of instinct. A chimpanzee will pick up a fallen branch and use it as a club. This, however, is using a natural object as a machine, not creating one. There is no real manufacturing involved. In their natural state chimpanzees have been observed to take a small branch and purposefully strip off all twigs for the express purpose of using it to capture termites [794]. This is not done by instinct; rather, it is either learned from another chimpanzee, or it is independently discovered through the act of experimentation.

The fossil evidence indicates that the immediate ancestors of the hominids had nervous systems comparable to a modern-day chimpanzee's. Therefore, they probably had at least as much machine-making capability. From this it follows that the early hominids probably used natural branches and stones as simple tools and could probably make simple but purposeful modifications and choices such as stripping a branch of all twigs or choosing a conveniently shaped stone for a specific purpose. This is enough to have given a slight advantage and opened a new way of life to our ancestors who acquired a bipedal capability.

Hominid Evolution

The evolution of humanity has been the evolution of the capability to create and use machines. Once the hands were free while walking, even if this was only a temporary freedom, there was a strong evolutionary pressure to enhance bipedal walking capability. The greater percentage of time the hominid could remain upright and keep his hands free, the better off he was. By about five million years ago, the hominids had acquired the upright posture characteristic of modern humans and their hands and arms were almost entirely devoted to making, carrying, and using machines while on the ground. This is also the period when chimpanzees and hominids separated from a common ancestor. The gorillas are generally believed to have separated about ten million years ago, the orangutan about 14 million years ago, and the gibbons about 20 million years ago. This is confirmed by DNA dating [600], a method for determining how close species are genetically in terms of when they last shared DNA with a common ancestor. Some very recent evidence not yet published by anthropologist

Vincent Sarich and his associates indicates that hominids, chimpanzees, and gorillas all separated from a common ancestor about five million years ago. However, the previous figures are more commonly accepted.

In the case of the orangutan, gorilla, and the chimpanzee it is likely that their immediate predecessors were more like hominids than like them, e.g., Sivapithecus and Ramapithecus. The knuckle-walkers (pongids) may represent early specialized hominids. From about five million years ago, the hominids were clearly inferior to the pongids in tree-climbing ability, but they were far better walkers and runners. From the neck down the hominids were structurally almost indistinguishable from modern humans except that they were shorter and more rugged.

At the same time that the hominids were changing from the neck down, another change was occurring in the skull. Among the first changes was probably the loss of the great canines which characterized the pongids. These canines are used primarily for fighting among the male pongids for the purpose of establishing dominance and having first access to the females and food. It is a characteristic of the evolutionary process that any organ or structure which plays little or no direct role in survival will atrophy, since there will be no natural selection against the mutations which cause it to atrophy. Once the hominids began to depend on tools for fighting and gathering food, there was a clear survival advantage for the more efficient tool users over those who depended more on their large canines. A tool is a machine which transforms energy from the muscles, bones, or teeth directly into useful work. It might be considered an amplifier of our body structures. Therefore, the canines atrophied and the shape of the mouth and face changed. This eventually made modern language possible. However, there was relatively little development in brain complexity during this time, which was also essential for language.

So long as the hominids were filling a new ecological niche somewhere between the baboons and pongids they merely expanded over the parts of the earth which were hospitable and which they could reach. However, it is likely that all major evolutionary progress of the hominids from earliest Australopithecus to *Homo sapiens* occurred in Africa. There is apparently something about Africa that is conducive to hominid evolution—perhaps its ecological richness.

The main pressure was on developing full upright posture and tool-using capability. Stone-throwing gave hominids a unique biological advantage and contributed to the development of the nervous system in determining trajectories and in choosing and handling the right kinds of stones. The early hominid expansion was limited to the temperate zones of Africa. The early hominids were still dependent on the trees for safety, but they could wander further away than pongids because of their running and tool-carrying capability. There was, at this time, little evolutionary pressure to enhance their tool-making skills because there was a large part of the world

to be filled and the hominids had little competition from other primate tool users. From very humble beginnings, the hominids would expand and fill the ecological niches of a tool-using species which got most of its food from the ground but still was partially dependent on trees for safety and some food. Once these ecological niches were filled, then the hominids began to compete against one another and further develop the brain. (Remember, we are speculating.)

What happened was that because the hominids lived in widely scattered, relatively isolated small bands, considerable evolutionary development could occur in one hominid group without affecting another. At this time the total hominid population on the earth, virtually all in Africa, was probably not more than a few hundred thousand. There are about three hundred thousand chimpanzees today, all native to Africa. The chimpanzees have remained virtually unchanged during this period. Once one group of hominids had a clear advantage in its machines and/or their use over other hominids, it would begin to re-expand into the territory of its less developed cousins. Through natural selection the hominids with better machine-making capability and/or social organization would replace the less evolved hominids.

Human social organization is a machine in which the components are human beings. Therefore, hominid evolution became primarily one of internal competition between different hominid groups. This does not mean that there was a purposeful genocide by one group against the others, but merely that the more evolved groups preempted the food supplies and out-reproduced the less evolved groups. Once this process started, about five million years ago, there was considerable pressure put on brain evolution for the purpose of creating more complex machines, including hominid organization. During the last two-and-a-half million years the average hominid brain was to triple in size.

One of the consequences of developing an upright posture was a modification in the hominid pelvis which severely restricted the size of the birth canal. This meant that expansion of the brain was only possible if the young were born at ever more immature stages of development. Therefore, the young were completely dependent and highly vulnerable for a long time after birth. This produced evolutionary pressure for the development of emotional programming in the brain that would be conducive to the formation of family units in which the mothers and their offspring were protected and provided for by the males. The process of increasing immaturity at birth began once upright posture began to have clear evolutionary advantage and continued until about 50,000 years ago, at which time the disadvantages of extreme immaturity at birth outweighed the advantages of greater brain size, primarily because of an excessively high infant mortality rate. At the same time the interdependence between male and female became even more pronounced.

The extreme immaturity and long-term dependency of the hominid newborn made it imperative that the young be under constant maternal care for many years after birth. It was very difficult for a hominid female to gather food, let alone hunt, while caring for the young or in the latter stages of pregnancy. Therefore, the hominid males had to become emotionally predisposed to provide for and protect the females with whom they mated, or the hominid line would have become extinct. At the same time the female had to become attached to a male protector once she become pregnant. This mechanism is known as "the sexual bond." It occurs among many mammalian and avian species, particularly predators. It was probably enhanced among the hominids by the relatively higher sexuality of the females. Today the only female animals that are known to experience orgasm and are almost always sexually receptive to their mates are humans. The long-term nurturing instincts of the female, together with the growing socialization and protectiveness of the males, made it possible for the early hominids to form into mutually supportive family bands.

To a certain extent this banding into family units exists among all primates. The baboons, which share with the early hominids the dangers of predators when they are away from trees, are organized into bands called troops ranging usually from 15 to 50 individuals. The females and young stay near the center of the troop and are protected by the adult males who guard the periphery of the troop. The males themselves are organized into a rather complex hierarchy of dominant groups and dominant individuals within each group. If a member of a male group is threatened by an outsider seeking to assert his dominance, the whole group will cooperate as a unit to ward off this threat [220]. This hierarchy of structure imposes a group discipline which permits the troops to have social stability and to function together as a unit, very much the way a military organization does. The evolution of baboon social behavior required many millions of years of natural selection which centered primarily on changes in the emotional centers of the brain, as opposed to the reasoning centers in the neocortex which are used in machine building and cognitive processes.

The early hominids were probably more like the chimpanzees, who most closely resemble the protohominids physically and are closest in their genetic and emotional makeup to humans, as opposed to the more specialized baboons. The chimpanzees do not have such a rigid or complex hierarchical social structure as the baboons. A baboon may stay in the same troop it is born into all its life. Chimpanzees move from one family group to another with considerable ease. The male-dominance pattern of chimpanzees is more individualistic and does not involve as much organization into aristocratic cliques as among the baboons. The females live closer to the trees and are readily able to provide for and protect their young without help from anyone. Yet humanity's current social behavior is much more like that of the baboons than the chimpanzees.

As the hominids were spreading over the earth they were at first probably organized into small family units of one dominant male and probably not more than four adult females and their young. A bonding mechanism evolved such that the male assumed responsibility for each female with whom he mated and her young, and the female became faithfully attached to and dependent on the male. This is the "evolutionary contract" within our species. This type of social structure occurs currently among the gorillas, who are in some ways more like the early hominids than the chimpanzees, since they spend a larger percentage of their time on the ground, and only the young and the females climb trees for protection. The difference is that the gorillas have become specialized to an exclusively vegetarian diet. The male gorilla, who has difficulty climbing trees, protects the much smaller and more vulnerable females and young by warding off almost all predators (as opposed to scrambling for a tree) by virtue of his extreme size and strength. The females with young are not nutritionally dependent on the male.

The gorilla is more specialized than the chimpanzee in terms of diet and body structure. This type of specialization, together with human predation, is slowly bringing about the extinction of the gorilla, since its niche overlaps both that of humans and the chimpanzee, each of which is more adept in its sphere. There are only about 15,000 gorillas left in the world as opposed to several hundred thousand chimpanzees and five billion human beings. However, the large increase in the number of human beings is mainly due to a psychosocial phenomenon of the last 50,000 years in general and the last 10,000 years in particular (which will be discussed later). Up to about 50,000 years ago, the hominid population of the earth was less than one million. For now we can assume that the early hominids had an emotional structure somewhere between a chimpanzee's and a gorilla's and were evolving toward a social structure similar to a baboon's.

The early hominid families would probably cast out the male young as they matured, and the female young left when they mated outside of the band. The male sought to have as many females as he could protect and provide for and avoid competition from any other male. The early hominids were not primarily hunters but gatherers and probably scavengers, driving hyenas and other smaller scavengers away from the kills the large predators left behind, probably by throwing stones. As they adapted better to a walking and running existence, they began to include more meat in their diet, and eventually they became primarily hunters.

During the first wave of hominid expansion, which lasted about three million years and was limited to Africa, the hominids' hunting was probably limited to capturing the young and lame of other species, including the anthropoids and possibly an occasional hominid from another group; so the chimpanzees hunt today. Eventually the hominid dexterity in the use of clubs and stones was sufficient to start bringing down more difficult but

still small game. Today chimpanzees throw stones at potential predators to ward them off, but they can not bring down game in this way, at least not reliably. During this phase of evolution hominids began the first fierce competition amongst themselves.

Just as the hominids were acquiring full upright posture and filling all ecological niches available to them, climatic changes were causing the vast tropical forests which covered much of the earth to be replaced to a great extent by grasslands. This was most disadvantageous to the tree-dwelling primates, but it gave the hominids a considerable advantage. The upright posture of the hominids enabled them to see predators from a distance in the high grasses. The hunting skills they had acquired enabled them to do without the shelter and the food of the trees much better than the other primates. At this point the hominids, which had a precarious foothold on their niches, began to expand and all the other primates to decline. The tree-dwelling monkeys were later able to expand again into forests of Asia and South America, but the pongids were never to catch up to the hominids again, and some, such as the gorilla and the orangutan, are on the verge of extinction, primarily from human pressures.

Those noncortical mutations in the brain which predispose the hunting animal toward aggression and the cortical mutations which predispose him toward learning now began to be strongly selected among the hominids. About three-and-a-half million years ago a strain of hominids known as *Australopithecus afarensis* had a brain not much different in complexity from that of a pongid. However, Australopithecus was a fully upright omnivore and a hunter. He used tools of stone to help him catch and eat meat and to defend himself. Although he weighed less than 100 pounds and could not run as effectively as any of the large quadrupeds of the grassy African savannahs, he competed against all the predators and scavengers which abounded there. And in the end he won the battle. Early, not late, Australopithecus was almost certainly the ancestor of the modern humans.

The Australopithecines

The Australopithecines were a wide-ranging and varied group of hominids who began to spread over Africa about five million years ago. The rapidly receding forests opened new niches for them and they became a significant part of the primate biomass. They now exclusively occupied the top rung of the evolutionary ladder. Like all other generalized species at the main trunk of evolution, some of them began to specialize and fill in other niches. *Australopithecus robustus,* also known as Paranthropus, became a relatively large-bodied vegetarian who began to occupy the niche which had been left by the larger pongids. His large, flat rear teeth indicate that he might have given up hunting to concentrate on an exclusively vegetarian diet. He became extinct about one million years ago.

The oldest fossils of the genus homo (*Homo habilis*) seem to be about two-and-a-half million years old. The most recent skull of *Homo habilis* is from 1.8 million years ago (as of 1988). Therefore, the genus *Homo* coexisted in Africa along with the more specialized later Australopithecines for at least 1.4 million years.

It is clear that many of the early Australopithecines specialized into what are now known to be extinct lines of hominid development. The major form of specialization for the hominoids seems to be in the direction of becoming strict vegetarians. Those that choose this specialization become very large like the modern gorilla and the extinct giant hominoid Gigantopithecus. Part of the reason for increase in size is due to the necessity of having extra-long intestines for extracting as much food as possible from the less nutritious vegetation, which must be consumed in huge quantities. Gorillas, for example, spend an average of eight hours a day just eating. There is some evidence that the giant hominids (Meganthropus and his successors) which lived in southeast Asia until fairly recent times also became strict vegetarians.

Therefore, the main direction of Australopithecine evolution was toward a highly generalized hunter omnivore. So long as the Australopithecines were filling the evolutionary niches of a tool-using hunter omnivore in the expanding environment of the grassy savannahs, they were able to maintain their social structure of small family units with one adult male. At the same time, competition from other predators placed maximum evolutionary pressure on increasing brain complexity in order to develop better hunting skills—primarily by developing and more effectively using ever more complex tools. Eventually Australopithecus evolved into a large-brained predator, quite adept at solitary hunting. During this period, domesticated fire, shaped stone tools and probably spears were developed. Primitive spears were probably made by sharpening wooden poles on stones and hardening the points with fire. Shafted stone spears are a much later development. This enabled the solitary hunter to capture fairly large game, such as bushbuck, and defend himself against all but the largest predators. However, a large amount of the game biomass was in the large vegetarians such as the elephants, bisons, rhinoceri, etc., which were beyond the hunting capability of the solitary hunter and most of the large predators for that matter. Even a powerful predator such as a tiger cannot kill a full-grown, healthy elephant. As the small and medium-size game were depleted by Australopithecus and other predators, the large game proliferated. Natural selection now favored the kinds of mutations which would lead to the formation of larger hominid hunting groups in a new type of social organization.

Hunting and Evolution

The early Australopithecines would pass on their acquired hunting and tool-making skills to the young through example. Imitative behavior is a characteristic of hominoids in general and hominids in particular. Those Australopithecines that had the best brains would become the best hunters by virtue of having learned the necessary skills well and in rare cases by inventing new skills of their own. The best hunters could also attract and provide for the largest number of females and would, therefore, produce the greatest number of offspring. This provided the basic natural selection pressure for brain development. The young adult males would probably be driven out of the band when they began competing against their fathers for the females, or they would drive their fathers out if the old man had significantly weakened from age before the conflict arose. Therefore, only the most competent fighters and hunters reproduced. The human beard probably evolved during this period as a means of protection for the throat of the males in their mutual competition.

This same basic pattern exists among the gorillas. The adult gorilla is very tolerant and even protective toward immature males, but becomes much less tolerant after they mature. Similarly, adult male baboons behave protectively toward immature males but become increasingly intolerant toward them as they mature, unless they become totally submissive.

Natural selection worked on the female side primarily by her ability to nurture and care for her offspring and willingness to become bonded to a protective male. Therefore, natural selection worked on the emotional centers of the Australopithecine brain to produce maternal, submissive females attracted to dominant, aggressive males who were protective toward the females and their young but intolerant toward other adult males. The development of machine-making ability could not, of course, be strictly confined to one sex, since it is dependent on cortical structures. Only the emotional centers in the depths of the brain which are strongly influenced by the sex hormones, particularly during embryological development, could become highly sex-specific. Therefore, both males and females probably created machines, although not necessarily the same machines. However, the opening niche for hunters that could pool resources and capture large game put evolutionary pressure for further emotional changes in the male.

Group hunting would not have been an evolutionary advantage for the early Australopithecines because they did not yet have the necessary tools nor hunting skills for bringing down big game. Natural selection was based on the individual ability of each male and female. But about two million years ago, and possibly much earlier, group hunting was made evolutionarily practical by (1) the changes in ecology which Australopithecus had himself helped bring about by contributing to the depletion of small-

and medium-size game, by (2) the proliferation of large game and predators, and by (3) his own increase in numbers and hunting technology.

In order to have group hunting, the males not only had to have tolerance toward other males, but they had to actively cooperate and share the kill with them. The mutation that made this possible was actually a rather simple one. It was merely necessary for the adult male to extend his protective, friendly attitude toward his adult as well as his immature children and for the young adults not to be sexually attracted toward their father's mates or their sisters. A certain amount of this type of emotional programming occurs among the pongids, which have been observed to not be incestuous, at least not between mother and son. Some experiments done with human children indicate that children who are raised in the same family, independently of their blood relationship, are not strongly attracted to one another sexually. This emotional programming against incest has clear evolutionary value, since it minimizes the possibility of combining deleterious genes and maximizes genetic variability. Therefore, it was not necessary for the adult male to drive out his male children in order to form an exogamous breeding pattern among primitive, preverbal hominid societies. We note that exogamous mating maximizes the variability of any species and decreases the probability of deleterious genes combining. It increases the rate of evolution as does sexual reproduction.

The emotional mutation which made adult males tolerant and protective toward their adult children probably also made them less aggressive toward other males, but not necessarily tolerant. Therefore, group hunting probably began as a family enterprise where the dominant male and his older sons cooperated to bring down game. This opened a new ecological niche for the hominids since now virtually all animals were at their mercy. The fossil finds indicate that hominids of 300,000 years ago were already killing and consuming large numbers of elephants and rhinos. This took the cooperation of many adult males. The early group hunting was almost certainly limited to smaller game.

As group hunting developed, the needs for exogamy and group cooperation would bring different families together for brief periods, if for no other reason than the exchanging of mates. This type of social structure currently exists among the Australian aborigines. When the proper occasions arose, a group hunt would occur in which two families would cooperate. The families were closely related through their matings and were akin to a clan. Eventually several families working together saw that they could capture the largest game. Groups of families numbering possibly up to two dozen individuals would then form into close-knit hunting units. Some of the North American Indians had this type of social structure. But the hominids who engaged in this large-scale group hunting were not Australopithecines; they were our immediate ancestors and belonged to the genus *Homo*.

The Genus *Homo*

The genus *Homo* differs from the most advanced Australopithecine primarily in having (1) a larger brain, (2) a larger size indistinguishable from modern humans, and (3) smaller jaws and face. The Australopithecines seem to have had a brain no larger than 700 cc. The brain of *Homo erectus*, who followed *Homo habilis*, averaged about 900 cc. A fossil of *Homo erectus* 1.6 million years old was found in Africa in 1985. However, it is not until the period of about 500,000 years ago that extensive fossil representatives of the genus *Homo* are found all over the world except Oceania, Antartica, and the Americas. The earliest evidence of large-scale group hunting is from less than 400,000 years ago [152, 96].

There may have been an ecological balance for over one million years between group hunters of the genus *Homo,* who were in the minority, and solitary hunting and vegetarian groups of Australopithecus. It is also possible, but not likely, that the mutation to the genus *Homo* was made several times independently in different parts of the world and that this led to the four major races of today. This is the theory of race formation presented by C.S. Coon in *The Origin of Races* [156]. It seems unlikely, but not impossible, in the light of other examples of parallel evolution. There may also have been some disadvantage to the mutation to the genus *Homo* which made these isolated mutations extinct—for example, intolerance by the much more numerous Australopithecines. In any case, there is no fossil evidence at this time of the clear dominance within the hominid group by *Homo habilis* until about 2.5 million years ago. *Homo habilis* evolved into *Homo erectus* in less than one million years. All this time Australopithecines of the later specialized varieties abounded on the continent of Africa. The exact mechanism by which the Australopithecines were replaced by the genus *Homo* can only be conjectured. What is known is that over a period of 1.5 million years, families of Australopithecines were completely replaced by group hunters of the genus Homo.

Homo erectus had a brain that was already within the size range of modern humans (900 to 1200 cc). He could kill any land animal through group hunting. His social structure may have ranged from the single family to a small clan of about eight families totaling about 32 individual persons. The major evolutionary pressure was on skill for inventing, making and using better tools and on a new machine—social organization.

Early Social Organization

Just as a complex machine can be made through instinct, as in the case of social insects, birds, and beavers, so can complex social organizations be formed through instinct, as in the case of bees and baboons. Note that the

social organization is a machine in which the components are living beings. The early hominid social organizations, such as the small and large families, were based primarily on instinct. But when groups of families began to form into larger, permanent hunting groups, there had to be social organization which was not entirely instinctive. A system similar to that of the baboons had to develop, which gave a hierarchical structure to the group and a chain of command. Baboon social organization developed through many millions of years of evolution. Group hunting developed among hominids in no more than two million years and possibly in as little as 500,000 years. This may not be enough time to develop the complex instinctive responses characteristic of the baboons. Furthermore, there is no trace of instinctive social organization in humans other than the family. What exists is the primitive primate characteristics of dominance and submissiveness.

The basic mutations in instinct which made group hunting possible were (1) the extension of dominant male tolerance toward other adult males and (2) the sexual avoidance of taboo females by the adult males. This together with hierarchical dominance is enough to establish a chain of command and to make it possible for many adult males to live together, but it is not enough to make them hunt as a coordinated group.

The hunting of elephants involved separating the prey from the herd and then killing it. Elephants are intelligent, highly gregarious, and protective toward one another. The fossil evidence indicates that some of the elephants were trapped in pits or stampeded over cliffs. This took planning, foresight, and pre-arranged strategy. This cannot be done without some kind of language.

Language

Some anthropologists and linguists claim that humans could never have been group hunters without language. However, this is not necessarily true, as the group hunting of lions, wolves, and even chimpanzees indicates. So long as *Homo erectus* was hunting medium-sized prey, he could have probably gotten along without language by deploying around a prey and all attacking *en masse* on signal from a leader. But once this type of hunting began, there would have been considerable advantage to developing signs and signals for coordinating attacks and changing strategies when unusual situations arose. If this occurred, then there would have been evolutionary pressure to improve the communication system, and natural selection would have assured the survival and continued evolution of those hunting groups which had the best communication systems. So with the start of group hunting, the evolution of language was greatly accelerated.

We note that a rudimentary type of linguistic ability exists among the chimpanzees, who can learn, but not create, simple sign language. They also have clearly differentiated grunts for communicating.

The development of human language involved another modification in the neocortex and is probably the main cause for the rapid increase in brain size during this period. This represents a rate of increase in complexity unparalleled in evolution. There must have been an extremely strong evolutionary advantage for large brains, which began almost all of a sudden. The only feasible explanation seems to be the development of language, for the actual tools, although improved in this same period, do not represent that great an increase in complexity [152, 596].

Linguistic ability came into being long before there existed anything approximating a modern language. *Homo erectus* almost certainly used language primarily as means of communicating commands and storing simple facts, not for communicating the abstract thoughts which modern language is capable of [449]. However, this rudimentary language was a new machine destined for significant evolution. It made complex organization possible.

Through language it was eventually possible to tell someone to perform not merely a single set pattern, but a whole series of contingent actions. Organized hunting of the most complex kind was possible and likewise the corresponding social structure with complex hierarchies, duties, taboos, etc. The evolutionary pressure for tool building was still probably strong, and this required an improving brain also. However, tool building was almost certainly taught by example, as it had been for millions of years, and not by verbal instruction. Even today we best learn to use, make, and design tools by example and experimentation and not by verbal instruction. The main advantage of language was that it made possible a flexible, complex organization of human beings which could be passed on from generation to generation. From this time on the direction of evolution was based more and more on competition between groups and not individuals.

Organization and Evolution

Natural selection operated by assuring survival to the most effective hunting group and not the most effective individual, no matter how great his individual powers. Those groups which had the most superior individuals would have been most outstanding, other things being equal. However, the cooperation, sympathy, and discipline of the individual was just as important as his/her technical ability. Those groups which developed the most effective rules of social organization might out-perform another group in which the individual ability was greater. Those groups which became burdened with irrational rules of behavior and superstitions might be at a disadvantage relative to the other less entropic groups.

It was necessary for the group to be mutually supportive and protective, but it could not be burdened for long with defective members who

could not pull their own weight or who in other ways increased the group's entropy. Up to the present time the problem of what to do with parasitical human beings is a major ethical question. The Eskimos of a few hundred years ago solved it through group pressure, which drove the old and the crippled to commit suicide by freezing when they were a burden to the group.

In the past, dependent individuals simply died as soon as their parents stopped caring for them. Once group hunting started, there was survival value in nurturing wounded or sick adults who had valuable skills, because their abilities would in time reassert themselves. Even a permanently disabled hunter could be of value to the group if he could keep up with the group, which was constantly on the move, as are all hunters, and at the same time he could make tools and perform other services normally done by nonhunters. Thus, most hunting groups developed a social ethic which increased individual security by assuring group protection to those who became disabled, so long as they could perform valuable services.

A fossil has been found of a Neanderthal man who had lost an arm many years before he died, as indicated by the healed bone. He could not hunt or survive as an individual, but the group protected him for many years because it cherished him. A bond had been formed between him and the group which was similar in its effect to the sexual bond existing between mates. Some anthropologists call this the "hunting bond" [543]. It occurs between men who hunt together and become mutually interdependent. We see its manifestation today in the close friendships that develop between men who fight together as a single unit against a common enemy in wartime. This type of bonding does not seem to ever encompass more than about ten individuals at a time and sometimes many fewer. This is about the same upper limit as the number of adult male hunters that the primitive hunting groups could support. It is the same upper limit that most military organizations in the world today put on the most basic military unit—the squad or patrol. It is the same upper limit on the size of a team in most competitive team sports.

So long as humans lived primarily as hunters, they could not organize into bands totaling much more than 50 individuals. The average band was probably no larger than 32 with about eight adult male hunters. When game became scarce, the bands had to break down into even smaller subgroups possibly even to the individual family unit. This situation caused a change in male-female relations, since the basic polygamous pattern of the hominids for the past four million years—and of many primates in general and our closest relatives, the pongids, in particular—was no longer economically feasible. There was too much survival value in group hunting to have it succumb to the basic polygamous sexual instincts. It was advantageous to have as many male hunters banding together as the game density would support, but there was not enough food for all to have polygamous

families. Therefore, man became by necessity monogamous, as are almost all group hunting species. The most dominant males might on occasion have as many as two or three mates, but this was probably rare. The basic structure of hominid society from about 1.5 million years ago to about 10,000 years ago probably consisted mainly in groups of monogamous families, rarely exceeding eight families and having exogamous mating. The Eskimos who survived as group hunters in relative isolation until about 100 years ago had this type of social structure.

Monogamy and Sexual Selection

Sexual selection plays a very important part in evolution. As was indicated earlier, the development of sexual reproduction represented a considerable advance in evolution since it increased the variability of the population undergoing natural selection and, in effect, enabled the species to have a much higher mutation rate without significantly increasing the rate of deleterious mutations. So long as the hominids were pursuing the traditional, generalized primate mode of polygamous mating, with the most dominant male having the maximum access to the females, there was no particular evolutionary advantage for the male to be highly selective in choosing one female over another. He simply chose every female that was available, since under the proper circumstances he could literally keep hundreds of females constantly pregnant—although in practice he probably rarely had a harem that exceeded four fertile females, the maximum number of mouths a proficient solitary hunter could support. However, there was considerable evolutionary advantage for the female to choose the most superior male she could find to give her the most superior young and provide the best possible security for her and her offspring, since she could mate with only one partner at a time. Therefore, evolutionary pressure would produce emotional mutations so that the females were more sexually selective than the males. They would show overwhelming preference for the most superior males available to them, as do all primates today. They would also probably show jealously toward rival females who might endanger their security by diluting the protective capacity of the male with too many mouths to feed. Natural selection would favor females who gave overwhelming priority to caring for their own offspring. Therefore, there was already an evolutionary trend in developing monogamy among the female hominids, almost from the beginning of hominid evolution when the females became increasingly dependent on the males. Monogamy was evolutionarily optimal for the female. That is to say, the "fitness" of the female is maximized by monogamy, while the "fitness" of the male is maximized by polygamy. "Fitness" refers to the potential for producing progeny.

Since primate males tend to exercise absolute dominance over the females, the males imposed polygamy on the females. A compromise which

was optimal for the species was probably reached, one that emotionally preprogrammed the females to become increasingly intolerant of new rivals as the male built up his harem. Eventually the older females would band together to drive away any new rival whenever the protecting male was absent. As time went on, through natural selection, this intolerance toward new females increased so that the harems became constantly smaller on the average. At the same time, the larger his harem, the less interested the male became in adding to it, so that an evolutionary compromise was reached between the male and female halves of the species which produced an optimal family size from an evolutionary point of view. This was a compromise which would give maximum reproductive advantage to the most superior males while constraining the danger to the females and their offspring from having to compete for food and protection against their immediate rivals. The compromise was one which maximized the expected number of surviving offspring for the male.

As natural selection favored the growing intolerance of females against mating rivals, and the male harem decreased in size, there was an evolutionary advantage for the male to become more selective by choosing as his mates the most superior females, i.e., the strongest, healthiest, and most intelligent females. By the time group hunting became technologically feasible, there was already a strong predisposition toward monogamy among hominids, although it was considerably stronger in the female than the male. The choice of mate had long been a crucial one for the female, and it had become increasingly important for the male. Now it became all-important for both.

The survival of their progeny and their continued evolution depended on the choice of mate for both males and females. The evolutionary trend was toward growing, generalized intelligence. Therefore, sexual selection was probably strongly based on intelligence. Even today the strongest correlate between all measurable characteristics of married couples is their I.Q. [389]. It is not meant to imply by this that I.Q. is synonymous with intelligence, but rather that it is indicative of a limited aspect of intelligence. If a more direct measure of intelligence were available, it would probably be even more highly correlated for married couples. This correlates more strongly than any physical characteristic or even socio-economic background, religion, and values. It is an indication of ancient emotional programming that has been genetically determined for millions of years and is still operating. We see it on another level by the much greater selectivity of women in choosing sexual partners (not necessarily mates) than is shown by men [415, 416]. However, the new epidemics of sexually transmitted diseases are changing this pattern.

The important consequence of monogamous mating through intellectual sexual selection is that it probably increased the evolutionary rate for humanity [389].

Modest polygamy maximizes the evolutionary rate when there is high selectivity on both sides. But emotional preprogramming in the human male is such that he becomes highly indiscriminate when he has the opportunity of unlimited polygamous mating [415]. Only monogamous mating emotionally predisposes him to be highly selective. Therefore, monogamy not only was an essential prerequisite for group hunting, but it probably also accelerated the evolution of the human brain. Monogamy and group hunting together produced a synergistic interaction on the evolution of humanity in general and human intelligence in particular.

Group Evolution

Through exogamous mating and the development of language, there was a constant flow of information between different hunting bands in the form of genes and machines (tools, language, and social organization). As language developed, hunting bands which were isolated from one another became linguistically differentiated so that it was more difficult to exchange information when they met. This is analogous to the differentiation of isolated species in different environments. In time, there probably developed a hierarchy of communication between persons in which the freest flow of information was within the band, then within the clan, then within the linguistic group, and finally within the race. Taboos probably developed about mating outside the linguistic group. This and geographic separation probably gave rise to racial differentiation among *Homo erectus*.

As our ancestors continued to fill the earth, they came into conflict with one another concerning territorial rights; there was increasing warfare between bands, clans, tribes, nations, and races in that order. In this context, a "nation" is a set of all persons with a common language. The larger the number of hunters that could mass on one side, the greater the probability of success in battle; but the game supply mitigated against large concentrations of hunters. Therefore, those groups of bands that could develop a type of government for working together against common enemies would be more likely to survive and increase their numbers. This put even more evolutionary pressure on the development of language until the more abstract notion of hierarchical loyalties could be codified so that all persons knew their obligation to their family, their band, their clan, their tribe, and their nation. Probably an instinctive aversion developed, a type of xenophobia, to significantly different races (and as a consequence aversion to what were viewed as "inferior," i.e., different, cultures), or distinct races probably would not have formed except through absolute geographic isolation. The group hunting Indians of North America had these types of social organizations and behavior patterns, although they had much more evolved machines than group hunters of 200,000 years ago. There is also evidence of mass genocide occurring when very different hominid hunting

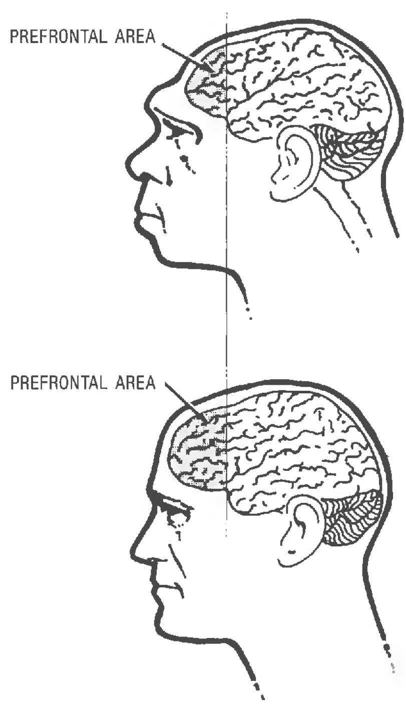
groups (different in culture or race) came together. In recent times this happened when the Iroquois exterminated the Mohicans, the Polynesians exterminated the Australoid aborigines, the Romans exterminated the Carthageneans, the Zulus exterminated the Bushmen, and, in Lebanon today, the Moslem and Christian Arabs exterminate one another. Similarly Cro-Magnon probably exterminated the European Neanderthals.

The Neanderthals

About 400,000 years ago, the hominids began to mutate into two distinct strains, each one of which was more like *Homo sapiens* than *Homo erectus*. One, the most generalized, was to lead directly to modern humans; the other led to a widespread and temporarily more successful group, the Neanderthals. The Neanderthals represent the last significant divergence from the main trunk of hominid evolution. Both the *sapiens* and the Neanderthal strains were to continue developing their brain, but the Neanderthal brain developed along a very different direction [152, 225] as shown here.

Neanderthal man had a very large average brain size (about 1720 cc). Neanderthal's prefrontal area was about one half the size of modern humans' and less than one half the size of Cro-Magnon's.

Modern man has a large average brain size (1350 cc, decreasing since the time of Cro-Magnon, who had a 1500 cc brain).



Homo sapiens' brain compared with Neanderthal's, showing the much greater size of modern man's prefrontal area and hence his greater capacity for ethics, creative forethought, and planning. (Figure adapted from Elliot [225].)

Both the *sapiens* and the Neanderthal strains developed along the direction of becoming more effective hunters. However, the Neanderthals emphasized an increased development in the sensory and motor centers primarily in the rear half of the brain, while the *sapiens* emphasized an increase in the higher centers—i.e., the speech, imagination, and, above all, ethics centers—in the front half of the brain, particularly the frontal lobes which were twice the size of the Neanderthals' [225].

Both developments were worthwhile. But that of the Neanderthals was more specialized, and it was of the same nature as having more acute vision and stronger muscles. The brain was reaching its limit of maximum size, because of the obstetric problem mentioned earlier, and it could go in two directions. Both changes would increase hunting effectiveness and even tool-making capability. The Neanderthals would become superb athletes with excellent memory for spatial relationships and the ability to discriminate between complex auditory and visual stimuli. They probably had greater manual dexterity than any hominid group before or since, and were capable of making excellent tools, considerably superior to those of *Homo erectus*. However, they probably had very limited linguistic ability. A recent analysis of the anatomical structure of the mouth cavity and larynx of Neanderthal man indicates that he could probably not even physically form the complex sounds of modern language. Perhaps even more disastrous at this stage of evolution was the Neanderthal's much less developed frontal lobes, which are the cortical centers of forethought, imagination, invention, and ethics. These are essential to create human organization. His superior sensory and motor equipment probably gave *Homo neanderthalensis* a temporary advantage over *Homo sapiens* in hunting ability, but the basic pattern of human evolution was not in this direction; it was in the direction of increasing ability to use, build, and invent machines. Invention is the most generalized ability that any species can have. It was an ability in which Neanderthal was relatively deficient, because of his brain structure.

Still, for several hundred thousand years Neanderthal man was able to expand over much of the earth and to completely dominate Europe. In Europe, which became totally glaciated during this period, Neanderthal man survived until about 30,000 years ago. Once he began specializing his brain in the direction of sensory acuity and motor dexterity, the rest of the body followed and he developed into a squat, very heavily-muscled creature with massive, bony eyeridges for protecting his eyes. The healthy, classic Neanderthal male was about 5 foot 6 inches and weighed about 200 pounds. (In comparing hominid subspecies and races it is convenient to consider the males instead of females because the males are more highly differentiated than the females.) Still, he developed very elaborate tools and great hunting skills so that he could kill the enormous cave bears of Europe; these he massacred in great numbers, possibly for food and to take over their caves, but partially it seems for religious purposes [152, 353].

Neanderthal man buried his dead in complex rituals which included decorating the body and providing it with tools. He almost certainly possessed a rudimentary art. He also seems to have practiced ritualistic cannibalism, which may have been limited to eating only the corpses of honored members of the hunting band or family who had died of natural causes. (He was probably a gentle creature who did not prey on his own kind, as is evidenced by his caring for maimed persons.) The practice currently occurs among certain Papuan tribes in New Guinea, which concentrate on eating the brains of honored ancestors. Neanderthals also seemed to perform trepanning rituals on each other in which the living brain was exposed, probably to let out evil spirits or let in good ones. Some Neanderthals survived this ceremony, as evidenced by the healed bone in the fossil skulls.

All in all, Neanderthals were quite human, particularly in their emotional makeup and solicitude for injured members of the band. They were religious, artistic, industrious, compassionate, and courageous. Their specialized brain was 25% larger than modern man's. However, they could not have been as inventive, well-organized, or ruthless as our ancestors who began as a small, invading minority from North Africa among the European Neanderthals and who in only a few thousand years had completely replaced them in what may be the first case of mass genocide on earth.

Cro-Magnon

Cro-Magnon is not only fully human, i.e., a *Homo sapiens*, but he seems on the average to have been superior to modern man in brain and body. The typical Cro-Magnon male was a superb physical specimen averaging close to six feet in height and weighing about 200 pounds. More importantly, he had a fully modern brain almost 20% larger on the average than a typical modern human brain! The implications of and reasons for this apparent degeneration in *Homo sapiens* will be discussed later.

The earliest *Homo sapiens*-like fossil—Heidelberg man—dates from 400,000 years ago and was found in Central Europe. There may have been an island land bridge formed across the Mediterranean by way of Malta during this period as the ocean's waters were taken up in the glaciers that were to cover Europe. By 100,000 years ago the Neanderthals were distributed all over Eurasia and Africa. It seems that the Neanderthal adaptations were primarily those of a hunter to extreme cold. He may have been very hairy, but most likely he made clothes out of skins for protection. The late European and Asiatic Neanderthal probably had a way of life very similar to the Polar Eskimos of a few hundred years ago, although they lacked many important Eskimo tools, particularly snowshoes and needles, modern language, and complex social organization. Cro-Magnon, on the other hand, seems to have evolved in the much more temperate climate and conditions of Africa, which enabled him to remain more generalized and then

invade Europe *en masse* about 45,000 years ago. Recent genetic evidence indicates that all humans are descendants of a single *Homo sapiens* Sub-Saharan African woman who lived about 200,000 years ago. All other hominids were apparently exterminated by this invading African strain of *Homo sapiens* [901].

Forty-five thousand years ago, Europe was completely dominated by the Neanderthal. Within 15,000 years all Neanderthals had disappeared. We know that there was very little interbreeding between the Neanderthals and the Cro-Magnon in Europe because there are no intermediate fossils. This might at first seem somewhat strange because, although it is conceivable that the Cro-Magnon men might have killed the Neanderthal males in dispute over hunting territory, it is characteristic of primitive men to subjugate the women of the conquered peoples and breed with them. If this had happened, then classical Neanderthal genes would have entered into the mainstream of human evolution through Neanderthal women and we would find fossils of intermediate hybrids. But this is not the case. Therefore, this was a true case of genocide. The Neanderthal women were either killed or left to starve. This might have occurred because of the evolutionary pressure for monogamous mating and the intolerance of Cro-Magnon women, but most likely it was due to the fact that the Cro-Magnon men were not sexually attracted to Neanderthal women. Knowing the male *Homo sapiens*' proclivity toward polygamy, or at least eclectic sexual adventure [415], this implies that the European Neanderthals had mutated into a subspecies that was almost universally repulsive to our ancestors. The Neanderthal men themselves might not have been so discriminating, but they were in no position to choose, and became extinct.

In the more temperate parts of the world, however, intermediate fossils between Neanderthal and *Homo sapiens* have been found from this period. It seems that there was strong evolutionary pressure in both the Neanderthal and the Cro-Magnon direction 200,000 years ago. Occasionally bands which had not gone too far in the *sapiens* or the Neanderthal direction would come together, interbreed, and produce hybrids. Through them we may all carry some Neanderthal genes, although the Cro-Magnon strain clearly predominates. The recent genetic finding that all humans are descendants of a single *sapiens* female that lived in Africa about 200,000 years ago is further evidence that the Neanderthals were exterminated when the African strain of *Homo sapiens* began to invade Eurasia over 100,000 years ago.

The European Neanderthal, having been isolated by glaciation from the rest of humanity for 30,000 years or more, carried the Neanderthal specialization to its limit. The Cro-Magnon evolutionary characteristics were probably developed in relative isolation from Neanderthal types for 100,000 years or more, and when the two subspecies met they no longer had enough in common to interbreed. It is even conceivable that they were

not mutually fertile, although this seems more far-fetched, since even lions and tigers are mutually fertile, as are the most divergent subspecies of dogs. The differences between the most divergent human races of today are not enough to prevent interbreeding. But the differences between the European Neanderthal and Cro-Magnon man were far greater than those between any two existing races, so there is a slight chance that they could not interbreed, in which case our ancestors of this period might not necessarily be guilty of deliberate genocide.

However it was that Cro-Magnon contributed to the extermination of Neanderthal, by 35,000 years ago he had a flourishing group hunting culture all over Europe. He had elaborate religious customs and was highly creative. He developed increasingly more complex tools, including the bow and arrow, created great works of art, and laid the foundations for the modern languages. Neanderthal man might have copied but did not invent the bow and arrow and other Cro-Magnon tools; if he had invented this superb weapon, it is he who would have exterminated Cro-Magnon and not the other way around. We further note that the Australian aborigines never invented the bow and arrow, although they did have the spear thrower.

The Basques may be the closest genetic and linguistic descendants of the Cro-Magnon. They (1) are anatomically similar to Cro-Magnon, (2) are the only group of persons to have over 60% Rh-negative blood types (an ancient characteristic), (3) live in the same isolated regions about the Pyrenees as the early Cro-Magnon, and (4) have a unique language unrelated to all other languages. However, the Cro-Magnon of yesterday, like the Basques of today, have interbred with the succeeding waves of humanity who came to Europe from Asia and Africa to produce all modern European types. The Europeans are only one of the many races which constitute *Homo sapiens*.

Homo sapiens

All living hominids are members of the same species, *Homo sapiens*. The earliest clearly *Homo sapiens* fossil is about 75,000 years old. Some anthropologists classify *Homo neanderthalensis* as *Homo sapiens*. However, for the reasons discussed in the previous two sections, this does not seem to be proper, particularly since there was so little interbreeding, for whatever reasons, between *Homo neanderthalensis* and Cro-Magnon (who existed in the same areas for over 15,000 years).

The evolution of *Homo sapiens* has been almost entirely cultural, not biological. Indeed, we seem to be degenerating biologically. *Homo sapiens* has carried the main trend of hominid evolution, i.e., the increasing ability to create and use machines, to its logical conclusion and has become completely dependent on machines; this is one cause for the degeneration of the body. A certain amount of biological adaptation has occurred, as shown in

the diversity represented by the five basic racial types, namely the Mongoloid, Negroid, Caucasoid, Australoid, and Capoid.

The mongoloid characteristics are a biological adaptation to extreme cold (epicanthean eyefolds, coarse insulating hair, abundance of subcutaneous fat in the face, low surface area to mass ratio, relatively few sweat glands, etc.). The negroid adaptation is one to extreme heat (dark skin, relative abundance of sweat glands, ventilated sun helmet of kinky hair, high surface area to mass ratio, etc.). The nilotic negro is a desert dweller and the pygmy a forest dweller. Both seem to be descendants of a common intermediate type. The caucasoid characteristics are not so much an adaptation, with the possible exception of the long, thin, air-warming nose, as a degeneration—although the pale skin is a degeneration which gives advantage in a cool, cloudy environment by increasing the amount of vitamin D synthesized in the body by the action of sunlight. The Australian Aborigine is the *Homo sapiens* most like our ancestors of 100,000 years ago, although he has a much smaller brain and thicker skull than Cro-Magnon man or any other living race of man, and indeed has many characteristics of *Homo erectus* [30]. Racial differentiation between negroids and other human populations began about 115,000 years ago ($\pm$ 34,000 years) and about 40,000 years ago ($\pm$ 15,000 years) between caucasoids and mongoloid types [901]. There has been no absolute genetic isolation between races in the last 100,000 years except for the Australian Aborigines, who were genetically isolated for at least 30,000 years.

Many other human types represent more generalized races which have not specialized as much as those noted above or which are hybrids of several more specialized races. In terms of their biological success, the caucasoids are first (55% of the hominid biomass); then come the mongoloids (37% of the hominid biomass); together the mongoloids, caucasoids, and their various hybrids account for over 92% of the human species. The negroids account for less than 7% of the human species, and the Australoids and capoids are less than half of one percent of today's humanity [30, 172]. It should be pointed out that the large increase in caucasoids is a phenomenon of the last 300 years. Up to that time, the mongoloids had been in the ascendancy, competing off and on for the last 10,000 years with the caucasoids for domination of the hominid biomass.

Since the advent of *Homo sapiens*, evolutionary competition has become increasingly bloody and direct between the various human subgroups. The basis of this competition has been the ability to create and use the complex machines which are the means of modern hominid evolution. The machines are used to control the natural resources—hunting grounds, arable lands, minerals, people, etc. The most important machine for the last 10,000 years or possibly longer has been human organization. For when humans could organize themselves into a progressive society which enhanced the basic evolutionary pattern of increasing the coherent infor-

mation within the biomass, then they could create ever greater machines and increase their numbers. There was a constant interplay and synergistic interaction between the machines of language, organization, and tools. For humans, evolution is now almost entirely psychosocial.

Psychosocial Evolution

Psychosocial evolution is unique to the hominids. There is no evidence that any other animal group evolves or has ever evolved this way. As was pointed out earlier, the basic process of evolution involves an increase in the amount of true information in a system. In general, random mutations decrease the true information in the system and increase entropy, just as substituting words at random into a coherent book decreases the true information in it. However, if (1) books could reproduce much faster than they were being disrupted by random changes, and (2) those books which had the most coherent information reproduced much faster than those that had least information, and (3) the most incoherent books did not reproduce at all, then we might have a library of evolving books. However, this would normally seem like a very inefficient way of improving our library, even if we had books which followed the rules of natural selection. A much better way is to make nonrandom, directed changes in the books. This is precisely the process of psychosocial evolution.

We can look at a species as a library of true information. For all species, except *Homo sapiens*, this information is contained entirely in the collective DNA of the species, which clearly contains much redundant information, although each individual is unique. This DNA is constantly mutating and recombining into new patterns. Through natural selection, any species can continue to evolve until it becomes overly specialized. Then it becomes extinct. This has been the pattern of all evolution, including the hominids'. By building machines, humans increase their generalized intelligence and avoid specialization.

Early in hominid evolution our ancestors began to store extragenetic information. This was the information on how to build and use machines. This information was passed from one generation to the next; but it had to be learned after birth. No hominid has ever been born knowing how to build any machine, although they could have been born with a genetically determined body structure, e.g., a better brain, which made it easier for them than others to learn how to use and or invent machines. Invention was the essential psychosocial mutation which made this new type of evolution possible.

An invention is a new machine which can increase the "fitness" of the species. "Fitness," we recall, refers to the potential of a species or of an individual for producing progeny. Fitness is a direct function of nutrient-gathering, mate-finding, and reproducing capability. An invention is pro-

duced by rearrangement of the physical, biological and/or psychosocial environment into a new pattern which produces a new and/or more effective machine. For example, tools involve physical invention, medical care involves biological invention, language and social structure involve psychosocial invention. So long as the hominids were organized into small groups, the benefits of invention were limited almost entirely to the family in which the inventors lived and their descendants. Therefore, the ability to invent and pass on the knowledge of this invention to one's progeny was the major direction of the evolutionary change, once full upright posture was achieved.

The critical inventions which are responsible for human evolution are many and interdependent, e.g., tools, language, government, agriculture, science, mathematics, computers, radios, etc. Machines evolve from generation to generation analogously to a species. Eventually primitive technologies disappear and are replaced with more modern technologies which could not have existed without the previous now-lost technologies (e.g., very few living humans can make a fire without matches or other modern machines). Technology is the process for designing, building, and using machines. Therefore, the more evolved the hominids became, the more dependent they were on their nongenetically inherited technology—until today the typical human can no longer exist without either machines or accumulated knowledge.

The machines themselves became extensions and amplifiers of the body and serve the same functions as the more specialized organs in other species. A club substitutes for the massive arms of the pongids; a sharp stone substitutes for their sharp, large canines. A spear substitutes for the horns of the grazing animal; a knife, for the claws and fangs of a carnivore. A bow and arrow has no precise analog in nature, but it is superior under many circumstances to any combination of horn, fang, and claw. It is an extension of our stone-throwing ability. Today we build machines that enable us to fly faster and farther than any bird, telescopes and microscopes which enable us to see better than any unaided eye, electronic chemical sensors which enable us to smell better than any bloodhound, and language which enables us to process, store, and exchange information in a way which is analogous to the nervous system of our body. This capability is further amplified by the invention of computers and electronic communicators (radio and television). The pattern which emerges is that humanity is forming an interdependent collective entity with analogous but greatly amplified characteristics of its own body. Humanity is a unified whole of persons, machines, and knowledge. Each part is essential to the survival of the other. Together all the parts create a collective entity which can transcend biological limitations.

Biological Limitations

There are evolutionary limitations inherent to the structure of life as we know it. The major limitation is in the amount of DNA a cell can contain. The DNA containable in a cell is limited because the overall size of a cell is limited by the surface area to mass ratio and other physicochemical relationships. The surface area to mass ratio must be at least equal to the critical value for the human ovum, or the cell will not be able to exchange gases with its environment at a rate adequate to maintain a viable metabolism. Therefore, a cell cannot be more massive than about 10^{-6} gms, and since there must always be less DNA in a cell than its total mass, the complexity of life is limited to the amount of information that can be stored in 10^{-6}, or fewer, gms of DNA. Actually this is a very crude upper limit to the complexity of life, since (1) the actual amount of DNA in a cell must double before reproduction, (2) much of the cellular information must be redundant and/or used for self repair, or the cell will be highly unstable, and (3) the DNA is less than 10^{-2} percent of the mass of any cell. Therefore, a more realistic upper limit on the maximum amount of nonredundant DNA available for structuring the complexity of any given individual is probably closer to 10^{-13} gms. Whatever the case, it is clearly a finite amount of a fairly small order.

There are also other limitations such as the practical limitations on the size of the nervous system and the amount of redundancy that must be put in the nervous system to ensure stability and reliability. However, just taking the mass of nonredundant DNA as the limit to the genetic information that life can contain, we see that evolution solely through genetic mutations is quite limited, and probably not much more than the complexity of a human being is obtainable through this means. Humanity is already a highly unstable species on the verge of suicide [280]. However, the amount of coherent information available to humanity through psychosocial evolution is virtually unlimited. Humanity has continued and can continue to evolve culturally, although our bodies on the average seem to be decaying when compared with Cro-Magnon. The critical words are on the average.

The largest hominid cranial capacities ever observed occur in modern humans, not Cro-Magnon. Therefore, although the average human brain may be decreasing in size—and recall that there is more to complexity than size—the maximum complexity of the human brain probably is as great as or maybe even greater than it has ever been. The reason for the decreasing average brain size, while the maximum brain size is at least as large as it has ever been, is that as humanity invented agriculture (probably a female invention, as shown in Chapter 4) and civilized society, it became possible for relatively defective human beings to survive and reproduce by performing simple specialized services for the society as a whole. These persons

could not have survived in a competitive hunting society where they would have to perform many different functions—tool maker, hunter, warrior, cook, tailor, physician, etc.—but they could survive as a specialized part of a much more complex society. As society becomes more complex, it becomes possible for ever more defective individuals to survive and reproduce, until survival and reproduction are possible today for large numbers of total parasites who are incapable of even caring for themselves and would quickly die if someone less defective did not constantly provide for them and their children.

At the same time, as machines take over more and more of the specialized functions of human beings, it becomes possible for ever fewer persons to invent, produce, use, and maintain all the essential machines of society. Therefore, the range of human capabilities becomes broader while the average becomes lower, and increasing numbers of human beings begin to live parasitical existences in an increasingly automated society. It is possible for human evolution to continue, at least up to a point, at an increasing rate, even though the vast majority of the human race is degenerating.

Up to now the transcendence of the biological limitations on human evolution through psychosocial evolution has enabled humanity to evolve at an ever increasing rate and to compensate for the increasing entropy in pure biology. However, this is not a simple linear process, and increasing biological entropy can interact with all other components of human information to produce psychosocial entropy which can eventually reverse human evolution and lead to extinction, just as it has for so many other species. In order to see that this is the case, we consider the evolution of mind.

CHAPTER 3
The Evolution of Mind

Just as life is an effect of matter and the laws which determine the behavior of matter, so is mind an effect of life and the laws which determine the behavior of life. A mind is the set of all thoughts and perceptions which an entity possesses. Insofar as these thoughts and perceptions are predictable and controllable, the mind is conscious. Insofar as these thoughts and perceptions are unpredictable and uncontrollable, the mind is unconscious. To predict is to imagine an event correctly before it is actually perceived. To control is to deliberately cause the formation of a predicted event. A predicted thought or perception is simply any correctly imagined future event. A controlled thought is any event we imagine when and how we desire it. "Control" is an ethically neutral concept as we have defined it. "Control" in the sense of dominating another person is unethical, as will be shown later. For example, if we ask someone the time of day and he freely tells us the correct time, then this information is a controlled event which is not destructive or unethical. We clearly need to control our own bodies to some degree or we will, by definition, not be intelligent.

If there is anything that we know with certainty, it is that we have minds because we each have thoughts and perceptions. We cannot be certain as to what is causing our thoughts and perceptions or what they mean, but we cannot logically deny that they exist because we cannot be a figment of our own imagination. Therefore, our mind is an indisputable reality, which is at least as real as our body and may in fact be the ultimate reality.

Of Mind and Body

Our minds are related to our bodies, but not in an obvious way. Our thoughts are not identical to our bodies, or we could not distinguish between the two. We know that our thoughts are at least in part effects of our body because we can modify our thoughts by modifying our body.

In a famous experiment by the neurosurgeon Penfield, it was shown that by stimulating various parts of the brain it was possible to induce

hallucinations, i.e., thoughts and perceptions which to the experimental subject were indistinguishable from "real" experience [611, 793]. By the proper stimulation—electrical, chemical and/or mechanical—of the brain it is possible to induce the recall of forgotten events, hallucinate any sensory experience, and feel any emotion—fear, rage, or love [185]. These techniques are not precise, but the general types of thoughts are controllable by manipulation of the brain. The mind is clearly a field effect of the body just as gravity is a field effect of mass or the curvature of space, depending on one's point of view. The mind is also an effect of things other than the body; for the body is, at least in part, an effect of the mind, since by merely thinking and an act of will we can bring about changes in the physiology and chemistry of the brain and in some quantum processes (see Chapter 5).

Our bodies and consequently our minds are subject to modification by the external environment—physical, biological, and psychosocial. A sharp blow or severe electrical shock to the head, as well as chemicals which disrupt nucleic acid synthesis, can induce amnesia [611, 717]. An infection of meningitis or kuro will induce a wide variety of mental disorders. Being told that a loved one has died can induce grief and trigger aggression, suicide, or other destructive behavior. More specifically, a state of mind can produce changes in the body.

This is most clearly demonstrable by persons who learn to control at will their heartbeat, blood pressure, and EEG patterns through biofeedback training techniques in which they learn to associate a prior subjective mental state with a subsequent, objectively measurable physiological state [720]. Of course, simple mental states such as emotions can produce gross changes in body states—for example, suicide and the whole range of psychosomatic illnesses. There is suicide through depression, muscular convulsion through hate or fear, and nausea and vomiting through disagreeable visual perceptions. Therefore, we must conclude that mind and body are two different parts of a complex interactive system in which each can affect the other and neither can subsist without the other. Neither part precedes the other, but both evolve together, the complexity and entropy of one affecting the complexity and entropy of the other. This process is a tangled hierarchy in which the brain affects the mind, which in turn modifies the brain, which again modifies the mind ad infinitum. This is analogous to an infinite set of reflections of one mirror in another or, more apropos, to the process of autopoiesis in cells by which DNA creates proteins while proteins create DNA to produce the epiphenomenon of life. Consciousness is the epiphenomenon of an autopoietic interaction between mind and brain. The synergistic whole which is the mind-body system is called "intelligence."

Intelligence

An intelligence is a mind-body system. Neither mind nor a body alone is intelligent. The universal and only common property of all intelligence is its capability to predict and control the total environment—physical, biological, and psychosocial. The greater the capability to predict and control, the greater the intelligence. Evolution is the process of ever increasing intelligence within the universe. The increasing collective intelligence of the biosphere is the only common denominator in the evolutionary process.

Because the universe is an interconnected whole extending beyond time, space, and matter, no part of the universe is devoid of intelligence [62, 63]. This means that intelligence is a property of all matter and life, not just of humans. The differences we perceive are in the degrees and dimensionality of intelligence. There are other definitions of intelligence, but they are less useful in describing the evolutionary process and are more anthropocentric. Therefore, we will only use this definition of intelligence.

Matter predicts and controls a very limited aspect of the environment—the integrity of its own structure. Any material system is homeostatic, for however briefly, and seeks to maintain a specific structure. The higher the entropy of the system, the more stable it is and the longer it will maintain its current structure. Therefore, within the world of matter, nucleons are more stable than atoms, simple atoms are more stable than complex atoms, atoms are more stable than molecules, and simple molecules are more stable than complex molecules. The more complex the structure of matter, the more intelligence it takes to maintain its structure and keep its entropy from increasing.

Matter, like life, can grow in complexity through a specialized or a generalized path. As in the case of life, the specialized mode of development leads to extinction. Atoms which increase complexity solely by adding nucleons and electrons eventually become so unstable that it takes superhuman intelligence for them to maintain their structure for even an instant. We see this in transuranium atoms, which are the most complex atoms known, with atomic weights of several hundred.

Carbon is the only fully generalized atom which can serve equally well as either an electron donor or an electron receiver. Silicon is a close second. As a consequence, carbon can form more stable compounds than any other element. The forming of compounds is a more generalized method for increasing an atom's complexity than the adding of nucleons and electrons. It leads to entities with atomic weights of several million. Silicon has similar chemical properties to carbon, but it is already more specialized and its compounds are less stable. A corollary of this is that a specialized entity is generally more unstable for a given degree of complexity than a generalized entity. This was fairly obvious in the case of animal

evolution, but it is more generally true in the case of material evolution. From this it follows that all life forms everywhere in the universe should be based on carbon and not on silicon, because self-replicating silicon-based molecules could not effectively compete against self-replicating carbon-based molecules in any natural environment. If silicon-based life forms ever evolved, it would have to be done artificially by deliberately insulating the silicon systems from having to compete against carbon systems.

From the preceding it is clear that the intelligence of matter is in one-to-one correspondence with its structure and that the more complex matter is, the more intelligently it behaves. As was indicated in Chapter 1, there is no clear demarcation between complex material and simple living systems. Therefore, there is no clear demarcation between the intelligence of complex matter and that of simple life. The difference is mainly one of degree, not of kind.

Life clearly predicts and controls more of the total environment than matter because it must maintain the stability of a much more complex system. Reproduction is already a predictive and controlling property of life that does not exist in simpler matter, although we have seen that it does exist in complex low-entropy matter such as self-replicating molecules. What life does—which matter never does—is to predict and control the behavior of other life forms and make choices. This is obvious with the amoeba (see illustration on page 121), which senses, intercepts, engulfs, metabolizes, and generally uses for its own purposes another living creature such as an alga cell. It makes a choice to consume other cells. Therefore, the evolution of life is based, in part, on predicting and controlling the behavior of matter, as is clearly demonstrated in the photosynthetic life forms; but a much more important and generalized capability is to be able to predict and control the behavior of other life forms and to make choices. Life seeks to maintain an evolving dynamic structure, while matter seeks to maintain a static structure. Life can choose and innovate. Matter can never choose nor innovate. Therefore, matter has intelligence only about matter; life has intelligence about life and matter. Humanity has intelligence about intelligence.

What is unique about human intelligence is that it can predict and control its own ability to predict and control. This is reflected by the human ability to direct its own evolution by increasing its extragenetic information. All other species are completely dependent on mutations in their DNA for evolution. Humans can evolve independently of genetic mutations once the complexity of their nervous system has increased to the point that they can create artificial components of their own intelligence. This notion of "intelligence about intelligence" is a dimensional quadrature called ethics.

Dimensional Quadrature

Dimensional Quadrature (D.Q.) occurs every time there is a quantum leap in evolution and an entirely new dimension of evolution is begun. (See discussion of major dimensional quadratures in the Introduction.)

1. The first D.Q. was the Big Bang.
2. The next D.Q.(s), according to the latest theories, occurred during the first fraction of a second after the Big Bang and is/are not well understood; but the end effect was to establish our own universe as a separate bubble with elementary particles of matter, as opposed to antimatter, and the laws of nature as we understand them.
3. The next D.Q. was the creation of hydrogen atoms—complementary pairs of protons and electrons—out of elementary particles.
4. The next D.Q. was the creation of helium atoms out of four complementary pairs of hydrogen atoms.
5. The next D.Q. was the creation of carbon, the first atom with four complementary pairs of active protons and electrons, out of helium—although all the atoms are part of the evolutionary process and represent more specialized subquadratures. There followed many subquadratures, leading to all the other atoms.
6. The next D.Q. was the creation of organic molecules based on carbon.
7. The next D.Q. was the creation of self-reproducing molecules.
8. The next D.Q. was the creation of life, with nucleated cells as a subquadrature.
9. The next D.Q. was creation of multicellular life, the metazoa, with many subquadratures as the nervous system evolved in ever more complex hierarchies to paired, quadruple brains.
10. The next D.Q. was the creation of ethical life represented by human beings with paired, quadruple brains—of highly developed neocortex, mammalian cortex, reptilian complex, and primitive fish brain—that enable humans to predict and control their own intelligence.
11. The next D.Q. was the creation of moral life by modifying the neocortex through its information so that some humans could predict and control their own ethics.
12. The next D.Q. will be the creation of moral supermetazoan entities with intelligence about morality—The Moral Society, with the new dimension of being able to create creativity.

At each D.Q. there is a new type of evolution possible and the evolving entity has ever greater control over its own evolution. Matter has no choice over its own evolution and is driven by deterministic laws, i.e., deterministic on the average. Life has more control over its own evolution, although it is still partially driven by random mutation over which it has little or no control. On the other hand, life can make choices that will affect its own intelligence.

Ethical beings, i.e., beings able to predict and control their own ability to predict and control, can create extragenetic information and become free of the tyranny of random mutation by evolving psychosocially. However, they are still subject to many forces of nature and ethical errors.

Moral beings make no ethical errors which are not quickly corrected. They can evolve forever except for the perturbations of the environment, particularly those of ethical beings not yet moral.

A Moral Society is free of the perturbations of beings not yet moral and eventually acquires the ability to evolve and help others evolve irreversibly by creating creativity. Therefore, there may be an infinite hierarchy of evolution with chaotic energy and matter at the bottom, human beings a few steps up from the bottom, and Moral Societies a few steps up from human beings. We will consider these hypotheses later; for now we focus on the nature of intelligence.

The Components of Intelligence

In order for any entity to display intelligence, it must have certain essential features which work together as a single system. These components and their relationships are shown in the figure on page 15 of the Introduction. Intuitively we define these gross components as follows:

Information (F) is the symbolic representation of events and their relationships; it always exists in minimal discrete units called "quanta."

Sensors (S) are receptors of Information (F) which translate the Information (F) into a representation which is useful to the organism. "Useful" refers to anything which increases the ability of the organism to predict and control its total environment.

Connectors (N) are conduits of Information (F) from the Sensors (S) to and between other parts of the organism.

Memory (M) is a system for storing Information (F) so that it can be retrieved by the Will (W).

Will (W) is that component of intelligence which directs the flow of Information (F) from, to, and within the organism; it can operate at the conscious or unconscious level.

Logic (L) is a system for sifting different pieces of Information (F) to determine whether or not they represent mutually exclusive events and relationships.

Effectors (R) are systems for generating Information (F) perceivable to the Sensors (S) by making physical changes in the environment.

Imagination (G) is a system that generates Information (F) independently of the Sensors (S) under direction of the Will (W) in such a way that logical inconsistencies are minimized.

Each of the components, of course, can be broken down into many subcomponents involving many complex relationships. For example: Information (F) is physical, biological, and psychosocial as well as true, false, or indeterminate. Sensors (S) are optical, auditory, olfactory, kinesthetic, thermal, etc. Connectors (N) are afferent, efferent, selective, discrete, analog, etc. Memory (M) is abstract, concrete, spatial, verbal, temporary, intermediate, permanent, etc. Will (W) is vectorial, directional, strong, weak, constructive, destructive, outward, inner, etc. Logic (L) is deterministic, probabilistic, wholistic, atomistic, selective, linear, nonlinear, etc. Effectors (R) are mechanical, chemical, electromagnetic, etc. Imagination (G) is open, closed, esthetic, mechanical, creative, destructive, spatial, abstract, etc. A diagram showing all the possible fine components of intelligence would be too complex to have additional pedagogic value at this time. For now, we merely note that our figure (p. 15) and the preceding descriptions represent a simplified but still useful model of intelligence that can throw light on the basic process of evolution.

The Common Denominator of Evolution

The only common denominator in the evolutionary process is constantly increasing intelligence. Intelligence can increase in a specialized or generalized manner. Specialized intelligence is inherently unstable; it must eventually become extinct, as was shown in material and biological evolution. Specialization represents a closing of the mind-body system so that an ever narrower range of information is processed until entropy eventually destroys it. The closure occurs because an ever more limited flow of information occurs between the intelligence and the total environment. The flow of information between an intelligence and its environment is called "feedback." Positive feedback refers to information which tells an organism that as a consequence of its actions its intelligence is being increased or in some way it is succeeding. Negative feedback is information which tells an organism that as a consequence of its actions its intelligence is being decreased or in some way it is failing. Neither matter nor life nor mind can evolve without feedback. To see that this is the case, consider the flow of information in an atom, an amoeba, and a human.

Intelligence of an Atom

The atom exchanges information with the environment primarily through electromagnetic means. The electrons in the outer shell of the atom com-

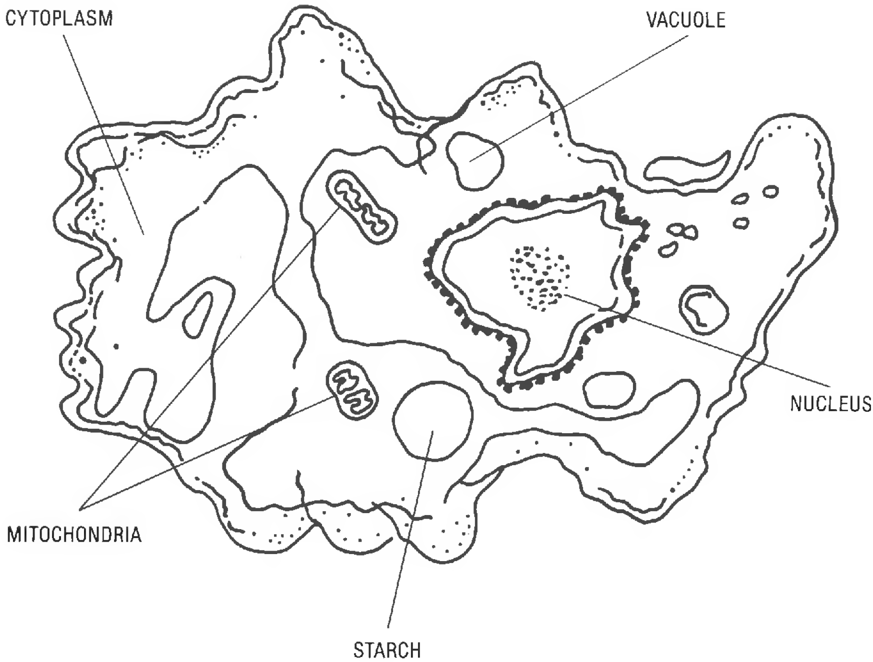
pletely determine its chemical behavior. If these electrons are properly excited, by light for example, they will go into a higher quantum state and absorb part of the energy of this light. Under proper circumstances they may release this energy by jumping back down to a lower state. The electrons serve as Sensors (S) and Effectors (R) for the atom. The quantum state is a Memory (M).

The central organizing part of the atom is the nucleus. The electric charge on the nucleus determines in part the behavior of the electrons in the outer shells. The nucleus itself is not structurally affected by changes in the outer electrons, but it is electromagnetically affected when electrons are lost, e.g., by thermal stripping in a star. In this case, the nucleus displays Imagination (G) and Will (W) by recapturing electrons and completing its outer shells when the conditions are appropriate, i.e., when it has negative feedback. The nucleus can Imagine a completed shell and its Logic (L) tells it when the shells are complete. For the atom, therefore, feedback Information (F) is conveyed in electromagnetic fields which are Connectors (N); its electrons are Sensors (S) and Effectors (R); Memory (M) consists of quantum states; Logic (L), Will (W), and Imagination (G) are displayed by the nucleus, which directs the recreation of the outer electron shells into specific structures, if these are disrupted.

Of course, an atom is completely determined by physical laws and it may seem strange to speak of it displaying intelligent, purposeful behavior. Yet the behavior of a human being is also at least partially determined by physical laws. The only difference is that, for all its complexity, an atom is a much more simple mind-body system than a human being. The number of options available to an atom are only a few dozen, and we can predict with reasonable, if not perfect, precision what the consequences of any given action will be on an atom. Because a human being is so much more complex, because we have relatively so much less information about him, and because he has billions of options, the human appears to have intelligence while an atom does not. The direction of evolution is to increase freedom and choices by increasing intelligence. As we have seen, both atoms and humans predict and control their environment; therefore, both are by definition intelligent. A human being is more intelligent than an atom only because he/she predicts and controls more of the total environment than an atom. An amoeba is between the two.

Intelligence of an Amoeba

The amoeba receives feedback Information (F) primarily through chemical and mechanical changes at its surface, which constitutes its Sensors (S). These changes are chemically propagated throughout the cell and cause further chemical changes in terms of the synthesis and the dissolution of molecules. The chain of chemical changes serves as a Connector (N)



The *amoeba,* a relatively large protozoan predator, is clearly an intelligent mind-body system that makes choices.

within the cell. The Information (F) is stored in terms of changes in some of these molecules which constitute the Memory (M) of the amoeba. When a certain chemical state exists, the amoeba flows around a prey, engulfs it, and metabolizes it (positive feedback). In a similar way, an amoeba will try to avoid an electric field (negative feedback) which disrupts its biochemical structure. The cytoplasm of the amoeba and its various subsystems, such as the mitochondria, are the Effectors (R). The Will (W), Imagination (G), and Logic (L) of the amoeba are programmed into the DNA molecules, concentrated in the nucleus, which have had Information (F) coded in them through natural selection to seek nutrients, metabolize them, and cause the formation of ever more copies of themselves. Logic (L) is involved in selecting nutrients and rejecting non-nutrients or choosing where to move. Imagination (G) is involved in foreseeing how to engulf a prey. Will (W) is necessary to continue the cycle. Whereas the atom does not have any choice, the amoeba is clearly an intelligent mind-body system that makes choices. The intelligence of humans is an extension of this.

Human Intelligence

In a human being, Information (F) is received in terms of electromagnetic waves through the eyes and the thermoceptors in the skin, which are Sensors (S). Information (F) is also received chemically through taste and olfactory Sensors (S), mechanically through auditory and pressure Sensors (S), and in the other ways. This Information (F) is conducted by nerves which are the Connectors (N) in the human mind-body system. Memory (M) is produced in and stored throughout the brain by the synthesis of Information (F) storing molecules similar to RNA and DNA, which go through a series of changes induced by the arrival of Information (F) through the Connectors (N), which also activate the Effectors (R) (bones, muscles, internal organs, blood, other body fluids, etc.). Logic (L) is inherent in the nature of nerve cells, each of which can make decisions, namely, (1) either transmit or do not transmit, and (2) if transmission is to take place, transmit specific molecules and electrical impulses. Together, systems of neurons form the brain and all its substructure which determine, at least in part, Imagination (G), Will (W), and overall Logic (L).

To a human being negative feedback is perception of his or her mistakes, attempts to predict and control which failed. Positive feedback is perception of his successes, attempts to predict and control which succeeded.

The overall Logic (L) produced by the brain is probably entirely an effect of the brain and its Information (F), since we can make excellent analogies between human Logic (L) and computers. However, this is not true of Imagination (G) and Will (W).

The closest analog to human Will (W) is the program within the computer. However, the human mind is self-programming. A computer program is more analogous to the instincts of animals, which have much of their behavior genetically predetermined. What is unique about the human Will (W) is our ability to make unlikely choices and to go against our strongest animal instincts, such as the instinct to survive and avoid pain. The human Will (W) is in fact a self-organizing program for maximizing intelligence or the appearance of this. The basic direction and the original instructions are hard-wired, but each human mind modifies the program and becomes either more intelligent or less intelligent. It seems that freedom of ethical choice is essential to maximize creativity. When this choice is taken away and fear is used through reward and punishment to induce any type of behavior, including ethical behavior, the creativity is destroyed. The human Will (W) can and has overcome all attempts of conditioning, no matter how great the punishments or the rewards, to make it go against the ethical direction. This is what makes us uniquely human.

The Will (W) uses the Imagination (G) to generate new Information

(F) independently of the Sensors (S) to complete the pattern of all perceived events and relationships so that there are no longer contradictions. As we all know our Imagination (G) can generate false as well as true Information (F). The Imagination (G) is ethically neutral, although not independent of our ethics as manifested by the Will (W). What is remarkable about Imagination (G) is that it can generate true information as often as it does. If the Imagination (G) were a random-number generator of Information (F), it would virtually never generate true Information (F). The fact that it does indicates that Imagination (G) may be in part governed by events outside of the mind-body system—events transcending matter, time, and space. More will be said of this in Chapter 5.

The final observation in this context is that when the Imagination (G) produces a new, true idea, this is analogous to a beneficial mutation in the genes. False ideas are analogous to deleterious mutations. New ideas are psychosocial mutations. New, true ideas are as rare as are beneficial mutations. Indeed a truly new beneficial mutation may have never been observed in the laboratory, although new deleterious mutations are commonplace. There is a close connection between evolution and human creativity. Just as generalized species are favored in evolution, so are generalized humans favored in the creative process.

Generalists and Specialists

To generalize is to increase all the components of intelligence in approximately equal amounts over relatively short periods of time. To specialize is to expand only a few components of intelligence and not expand or contract the other components of intelligence. A specialist is distinguished from a generalist not by what he knows but by what he does not know. The generalist will be much more intelligent about many more parts of the environment than the specialist, although the specialist will have more information but possibly less intelligence than the generalist about a few aspects of the total environment. To see how this could happen consider the following:

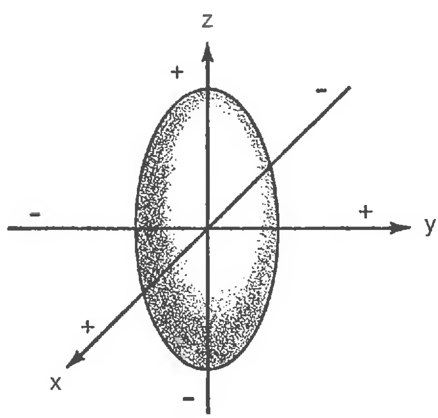
Assume all the information that exists is divided into three primary dimensions—the physical, the biological, and the psychosocial. The abstract, three-dimensional space of this information we might call Noö-space or "Mind space." Then a specialist and a generalist would appear as in the figure on page 124.

The surface area of each figure represents the total sum of knowledge and information. The intelligence is the interaction of all the information and is represented by the volume of each figure. A specializing Specialist is represented by an elongating ellipsoid. A generalizing Generalist is represented by an expanding sphere. As is well known, a sphere has maximum volume for a given surface area. Therefore, generalizing always maximizes

Generalists and Specialists

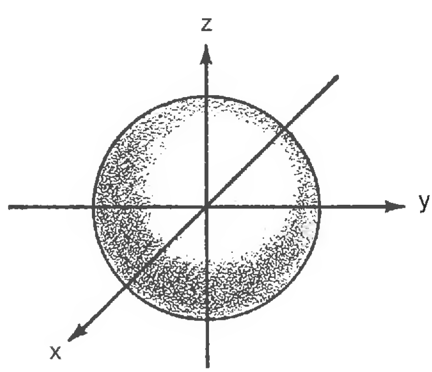
Graphical representation of intelligence in three-dimensional noöspace for a Specialist (a), and a Generalist (b)

(a)



Specialist, narrow awareness (Ellipsoidal)

(b)



Generalist, broad awareness (Spherical)

x-dimension measures physical information and knowledge.
y-dimension measures biological information and knowledge.
z-dimension measures psychosocial information and knowledge.
Surface area represents total knowledge. Volume represents intelligence.

intelligence. This model is true for circles and ellipses or their analogs in any dimension, i.e., it is true whether Noöspace has 2, 3, or n dimensions. It is even more true of the highest form of intelligence, creativity.

Creativity

Creativity is the capacity to generate new intelligence in ourselves and others without decreasing intelligence for anyone. It is a special dimensional quadrature of intelligence expressed by the following equation, which is the simplest equation meeting the boundary conditions.

Equation 3.1 $$C = IE$$

where: C = Creativity in quanta of new, true information generated per unit time.

I = Intelligence in quanta of old, true information predicted and controlled per unit time, minus old, false information acquired and believed per unit time.

E = Ethics in terms of current new, true information imagined and believed per unit time, minus current new, false information believed per same unit time, divided by total current information imagined per unit time. Therefore E is a dimensionless ratio between -1 and +1:

$$E = \frac{Y_t - Y_f}{Y_t + Y_f}$$

where: E is as above

Y_t = true imagined information

Y_f = false believed information

Intuitively Ethics are equivalent to the value a person puts on truth over happiness or to the amount of energy devoted to creative activity versus destructive activity.

Happiness is a state of mind in which we believe that our desires are being fulfilled. Desires that have been fulfilled do not make us happy. We are made happy only by desires that are being fulfilled. Unfulfilled desires make us unhappy so long as we have these desires. A person devoid of desire is neither happy nor unhappy. Happiness can be produced by self-delusion. Happiness and creativity are not mutually exclusive, but neither are they the same thing. We maximize happiness not by pursuing it but by maximizing creativity and ignoring happiness. More will be said of this later.

For now, consider the following table, in which the arrow $\Rightarrow$ is a symbol meaning *implies*:

Table 3.1: ETHICAL BOUNDARIES

$E = -1 \Rightarrow$ Condition of Immoral persons, who never create and only destroy. They care nothing for truth but value only happiness. They are incapable of imagining anything that is not false.

$-1 < E < 0 \Rightarrow$ Condition of Unethical persons, who destroy more than they create; they value happiness ever truth; they believe false information more often than they imagine true information.

$E = 0 \Rightarrow$ Condition of Trivial persons, who create and destroy in equal amounts. They value truth and happiness equally. They are just as likely to imagine true information as believe false information. Almost all subhumans are trivial entities. Almost no humans are trivial.

$0 < E < 1 \Rightarrow$ Condition of Ethical persons, who create more than they destroy. They value truth over happiness. They imagine true information more often than they believe false information.

$E = 1 \Rightarrow$ Condition of Moral persons, who only create and never destroy. They value truth and only truth. They care nothing for their or anyone else's happiness. They imagine only true information, and never believe false information.

Note: Destructiveness is negative creativity. Destructiveness represents the spread of false information or the elimination of true information.

Corollary: Unethical and Immoral persons have a great penchant for self-deception. That is how they seek to maximize their happiness.

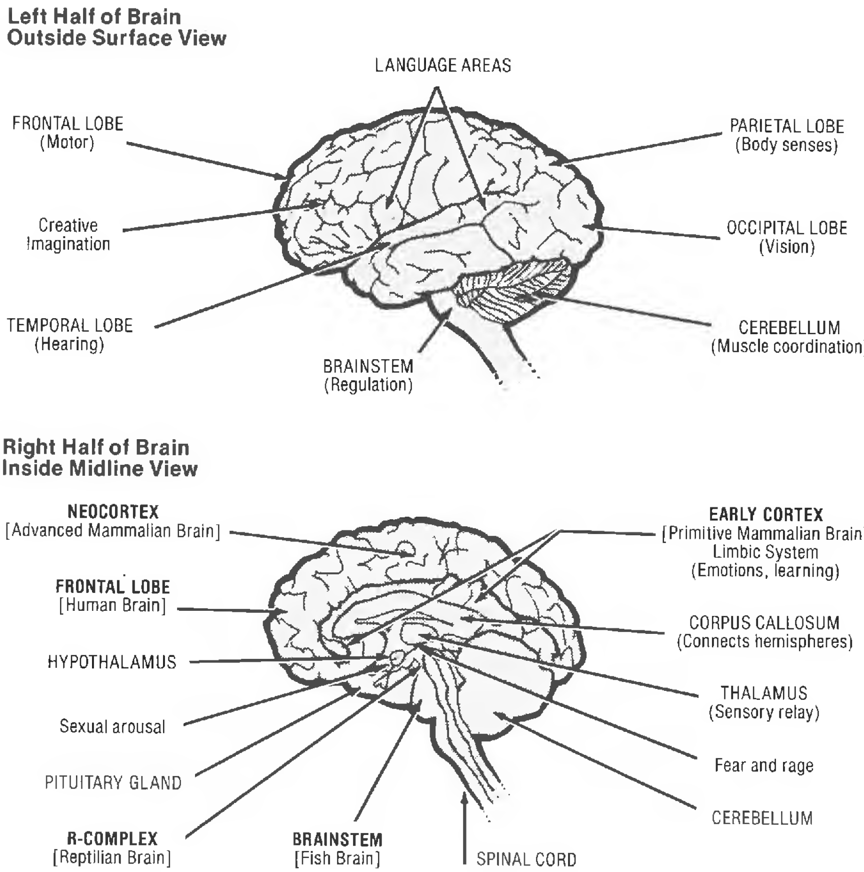
Ethics is a macro quantum operator associated with the frontal lobes. It will be discussed in Chapter 5. We merely note for now that generalization maximizes both Intelligence and Ethics, although it is theoretically possible to be generalized through conditioning and still be unethical. Ethics derandomizes the Imagination. When the Will (W) is ethically driven and not conditioned by fear it produces a generalized intelligence. Fear leads to specialization and the destruction of Ethics. All these phenomena are intimately involved with the structure of the brain.

The Human Brain

The unique feature in the evolution of the brain is that old structures are not replaced, nor do they merely grow and become larger. Instead, new

structures are constantly being added to the brain, thereby introducing new dimensions of capability. This is shown in the figure below, which indicates the evolutionary progression in brain development from fish to man [632, 720]. Relating this figure to the table and chart on page 128, we can see that within the human brain there is a fish brain, a reptile brain, a primitive mammal brain, and the neocortex, which we share in part with other apes and the higher mammals.

All those brains have Imagination (G), Logic (L), Memory (M), and Will (W) built into them; but in the simpler brains they have simpler functions, just as the components of intelligence have simpler manifestations in lower life forms. As each new structure is built upon the brain, under normal conditions it dominates the previous structures usually by selectively inhibiting certain portions of the more primitive brain when they conflict



The human brain, showing the major functional areas and, in the inside midline view, the evolutionary layering of structures from fish to human.

TABLE 3.2

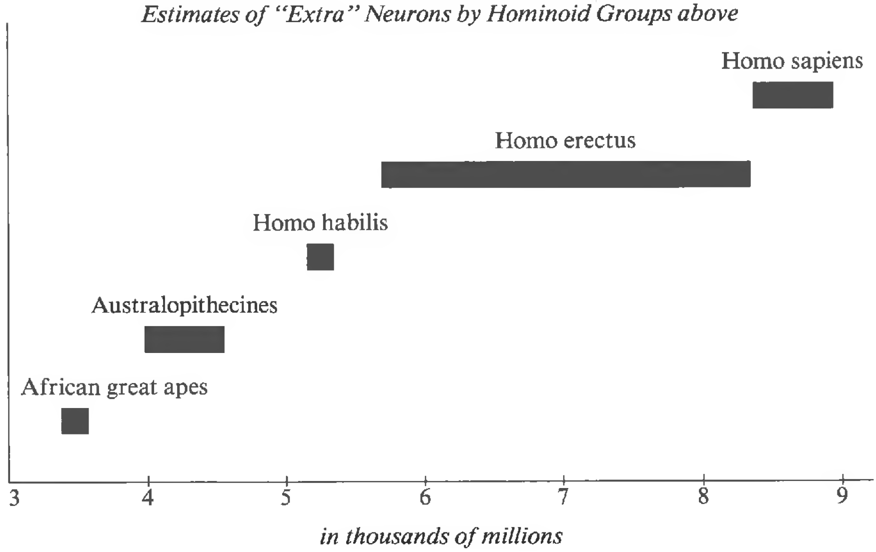
Estimates of "Extra" Neurons in Hominoid Brains

(Adapted from Tobias [777])

Hominoid Group	*Endocranial Capacity** *(in c.c.)*	*Estimated Body Size (in c.c.)*	*Total Neurons* **	*Body-Related Neurons* **	*"Extra" Neurons* **
Chimpanzee	400	45,000	4.3	0.9	3.4
Gorilla A	540	200,000	5.3	1.8	3.5
Gorilla B	600	250,000	5.7	2.1	3.6
A. boisei	530	50,000	5.2	1.0	4.2
A. robustus	500	45,000	5.0	0.9	4.1
A. africanus	500	25,000	5.0	0.7	4.3
Taung ("adult value")	540	35,000	5.3	0.8	4.5
Sterkfontein 60	435	25,000	4.6	0.7	3.9
H. habilis (type)	680	35,000	6.2	0.8	5.4
H. habilis (paratype)	650	30,000	6.0	0.8	5.2
H. erectus	750	45,000	6.6	0.9	5.7
H. erectus	900	50,000	7.4	1.0	6.4
H. erectus	1000	50,000	8.0	1.0	7.0
H. erectus (range)	750–1225	50,000	6.6–9.4	0.9–1.0	5.7–8.4
H. sapiens	1300	60,000	9.5	1.0	8.5
Varied pop. means	1276–1400	53,000–68,000	9.4–10.0	1.0–1.1	8.4–8.9

*Actual measurement **Estimated, in thousands of millions

Estimates of "Extra" Neurons by Hominoid Groups above



with the Logic (L) or Will (W) of the higher brain. The most outstanding difference between the purely human brain and the ape brain is the development of the neocortex.

The neocortex represents over half the mass of the human brain, but it is less than 10% of the ape brain. This is the part of the brain which underwent explosive development when hominids made the transition from Australopithecus to *Homo sapiens* by way of *Homo habilis* and *Homo erectus*. The neocortex is the most complex part of the human brain and is associated with all higher activities ranging from speech to invention.

Emotions, as usually understood, are a type of preprogrammed logic associated with the reptilian complex and early cortex of the mammals (the limbic system). Emotions trigger automatic responses in the Effectors (R); these are characterized as fearful or loving behavior. All emotions can be regarded as various manifestations of fear and/or love. This behavior requires little or no learning and has distinct survival value. Loving behavior, which is characterized by the nurturing and protection of the young, the mate, and/or other members of the species is almost totally absent in reptiles and almost universal in mammals and birds. Therefore, the emotion of love is probably associated directly with the early mammalian cortex, although the limbic system seems to modulate all emotions. Fear is primarily associated with the R-complex. A chimpanzee has the same range of emotions as a human. What distinguishes a chimpanzee from a human are his ethics and his capacity to learn, invent, and use machines. These behavioral differences are due to the human part of the brain, the neocortex.

As was indicated earlier, human evolution was made possible by emotional changes which first produced sexual pair-bonding between mates and then produced the hunting bond between groups of males. The sexual and hunting bonds together made it emotionally possible to form human society. However, it was the neocortex which made it intellectually possible for humans to create and use the increasingly complex machines which are today an overwhelmingly important component in human evolution. The neocortex differed from the other parts of the brain in that it was totally dependent on extragenetic, environmental programming to function. Its major function was to direct the synthesis of the machines which amplify human intelligence.

The Amplification of Intelligence

Human intelligence was first amplified by creating tools. This eventually gave the hominids Effectors (R) equivalent to or better than those of the most specialized animals without their having had to become specialized themselves. At first the amplification of human intelligence was limited almost exclusively to the Effectors (R). This is where humans were most

defective relative to other mammals. With the beginning of group hunting and linguistic evolution, humans began to greatly amplify their Connectors (N), Memory (M), Logic (L), and Information (F). This is where humans were most defective relative to each other.

Language serves as a social Connector (N) enabling Information (F) to flow between humans in a rapid and efficient manner. This is often a much more effective and general means of communication than by visual example or by crude reward and punishment, i.e., conditioning of desirable and undesirable behavior respectively. This latter type of communicative behavior exists among all mammals. But only humans systematically create languages. (The language of bees and many other animals is entirely instinctive and noncreative).

There is a slight possibility that the languages of the dolphins and other cetaceans have creative elements, but no experiments so far prove this. The large brain of the dolphin is apparently a specialized organic computer for causing and interpreting sonar signals. Cetaceans have neocortexes comparable in complexity to those of humans, but the frontal lobes are less developed. They and other higher mammals such as primates and the elephants may have a rudimentary ethics.

Language also provides an alternative means of storing Information (F) in terms of abstract symbols instead of visual images. In this way, through oral tradition, the cultural Information (F) of humanity could be passed from generation to generation in abstract form and not merely through visual representations. The oral tradition became the collective Memory (M) of humanity. The abstract formulation of extragenetic Information (F) within the human nervous system also enabled humanity to introduce the rudiments of symbolic Logic (L) into its thinking processes and thereby amplified its genetically structured Logic (L). The neocortex, through the machine of language, was therefore capable of amplifying Information (F), Memory (M), Logic (L), and Connectors (N).

In recent years there has been increased speculation about and growing interest in the alleged phenomena of extrasensory perception (ESP) in general and mental telepathy in particular. If these human capabilities existed and, more importantly, if they had survival value, they would have been subjected to natural selection in human evolution and we would communicate by mental telepathy and not by language. Furthermore, these alleged capabilities are of an organic nature and are not created; therefore, even if they existed they would represent an organic adaptation and not a psychosocial creation, which is the main trend in human evolution. By creating machines which amplify generalized intelligence through the unlimited growth in extragenetic information instead of forming new organic structures which further specialized intelligence, the evolutionary potential of humanity is maximized.

Through the continued evolution of the machine of language and

other related interactive machines—writing, mathematics, printing, radio, computers, etc.—the collective nervous system of humanity is being created, making it possible for each person to have access to almost all the creative Information (F) which has been accumulated up to the present. The Sensors (S) are now being amplified by telescopes, microscopes, radar, television, seismographs, thermocouples, and remote electromechanical Sensors (S) sent to other planets and linked to earth by new mathematical languages and radio waves which are becoming the cosmic Connectors (N) of humanity. The primitive tools (Effectors) of the early hominids have evolved into space ships, nuclear power generators, and cities. These machines give humanity greater collective intelligence today than any speculated extrasensory power of 100 years ago. The machines of 100 years hence can create greater collective intelligence than the whimsical speculations of the advocates of ESP today. Since the beginning of group hunting and probably before, the direction of hominid evolution was toward the creation of collective human intelligence through the integration of persons, machines, and knowledge.

Collective Intelligence

All intelligence is collective. The individual intelligence of the atom is the collective intelligence of the elementary particles and forces which constitute it as a coherent organized system. The individual intelligence of the amoeba is the collective intelligence of the complex of molecules and chemical forces which constitute it. The individual intelligence of a human being is the collective intelligence produced by the billions of cells which constitute its body and the forces which bind them together into complex interconnected systems of organs, nerves, bones, and muscles. The collective intelligence toward which humanity is evolving is a complex of individual human intelligences tied together by machines, knowledge, and ethics. This is the collective mind-body system we call humanity. It is a dynamic entity which began millions of years ago and extends into an uncertain future.

The future of human intelligence is discussed in Part II. In order to extrapolate toward the future, it is necessary to see the interactions which have occurred in developing collective intelligence at the psychosocial level. As was pointed out earlier, one of the prime machines in psychosocial evolution is human organization. Language, tools, and cities are effects and causes of human social organization.

Social Organization

Social organization is clearly not unique to human species, but manifests itself in species ranging from termites and bees to baboons and wolves. Social organization can be seen as an evolutionary attempt to increase

intelligence at a super metazoan level once a metazoan species is reaching an upper limit of complexity along a specific line of development. This is analogous to the early formations of cell colonies once cells were reaching their limit of complexity. All social organizations, other than human society, are almost entirely a product of genetically preprogrammed (hardwired) instincts and emotions. The human family and to a lesser extent the hunting band are probably also mainly genetically determined organizations. However, a human society with laws, language, religion, institutions, plus complex hierarchies of power and responsibilities is clearly not genetically determined, but is a complex psychosocial machine created by humanity. Like any other machine, human society is an amplifier of human intelligence and is subject to the law of natural selection. Those societies which can best integrate human knowledge and creativity in a system of growing capability to predict and control the total environment will expand and replace those societies which are less capable.

A human society is composed of the following interacting components: (1) a mass of individual human intelligences; (2) inherited and recently created knowledge and technology; and (3) an ethical code. In general the larger the collective mass of individual intelligences, the more intelligent the society will be, if (a) the knowledge and technology of the society are adequate to support and integrate these intelligences, and (b) the ethical code engenders cooperation and not mutual antagonism between the individual intelligences. However, as we can see from Equation 3.1, what maximizes intelligence does not necessarily maximize creativity.

Knowledge includes the sum of extragenetic true Information (F) which is available and usable by the society to predict and control the total environment. It includes all scientific facts and laws, but it excludes superstitions, prejudices, and other false information which does not enable persons to predict and control the objective world, but which subjectively convinces them that they can. This last type of information is entropic and is analogous to a deleterious mutation in the DNA molecule. In general, truth is information which enhances our intelligence whereas falsehood is information which decreases our intelligence when we believe it.

Technology includes the set of all machines—organizations, language, tools, buildings, books, computers, etc.—available to the society. The technology of a society is the set of all machines available to it and the processes for using, building, maintaining, designing, and improving these machines. Therefore, there is an overlap between the technology and the knowledge of society. Clearly the society is most intelligent if each of its cooperative members can use any of its machines. This is obvious in the case of language, because almost any current human society would quickly disintegrate without a common language. But it also applies to every other machine. A society which had an automobile for each person, but in which only a few knew how to drive, would derive very little benefit from this

machine amplification of its Effectors (R), i.e., the running and walking capability of its members. From this we can deduce a general principle that knowledge is most effective, i.e., maximizes intelligence, when it is shared by all cooperative members of the society. Whatever decreases the flow of knowledge between cooperative members decreases collective intelligence.

The limitation which runs throughout the above discussion is that members be cooperative. For persons to cooperate it is essential that they share at least one common goal. Insofar as they have contradictory or opposing goals, they will be uncooperative. The only evolutionary goal is to increase intelligence. Insofar as members of a society share the goal of increasing their intelligence and that of others, they will cooperate and continue to evolve. A short way of summarizing these points is to observe that we maximize intelligence not by seeking to maximize intelligence and ignoring ethics, but by seeking to maximize creativity. For humanity the purpose of evolution is to maximize creativity. Such a society will have an evolutionary ethical code. The question is, What happens when societies have a goal other than maximizing creativity? What kind of an ethical code, if any, will such a society have?

Social Goals

Objectively, we know that individuals and many human societies today and in the past have had goals other than increasing intelligence, let alone creativity. The United States was organized with the maximization of freedom, not intelligence, as the central stated goal. Communism was supposedly organized according to the principle "from each according to his ability, to each according to his need," i.e., material security, as the central goal. The communist principle is somewhat ambiguous since it does not state precisely what is expected from persons as a function of their ability, or how ability is determined, and it does not clearly state how needs are determined or which needs and whose needs have priority in being fulfilled. These ambiguities have all been resolved in favor of absolute, total control by the Communist party over every person who lives in a communist society.

The American goal of freedom was somewhat less ambiguous, and it could be stated according to the following principle: "Personal freedom is the right of each person to do and say whatever he pleases, so long as he does not in the process interfere with the right of another person to do and say as he pleases." Here the problem arises when someone claims that someone else is interfering with his freedom. Many Americans interpret this to mean "freedom from want" so that the communistic ethic is a subset of the democratic ethic. Lenin also aptly stated, "No amount of political freedom will satisfy the hungry masses" [707]. No matter how progressive and rich a free society is, there will always be persons who through stupidity, laziness, or illness may be poor if the society is truly

free. Only by limiting freedom is it possible to guarantee that no one is poor. In other words, "no one has the right to be rich so long as someone else is poor." This notion lends itself to democratic socialism as it exists in Sweden and other countries.

In the communistic and the American societies it became necessary to develop an ethic about how to determine priorities in accomplishing their stated central goals. This was the alleged purpose of the respective governments and their corresponding legal systems. As we shall see, both systems have begun to break down, i.e., become entropic, because the evolutionary goal of maximizing creativity has become increasingly irrelevant to these societies, and in the process they have ironically also deviated even further from their actual stated goals of maximizing freedom and material security respectively. But for a time both the American and the communist societies were able to evolve because their respective central unifying goals created a certain amount of cohesion among the people and engendered cooperation.

For convenience we will call the American goal of maximizing freedom the "democratic ethic," the Communist goal of maximizing material security the "materialistic ethic," and the goal of maximizing creativity the "evolutionary ethic." These goals are not mutually exclusive, but depending on which goal is given priority, the society takes on different forms, at least in the beginning. It will be shown that societies which do not give overwhelming first priority to the evolutionary ethic eventually all achieve a very similar entropic final form, irrespective of their stated ethic, and end up with neither freedom, security, nor creativity.

Social Entropy

One of the definitions previously given is that entropy is a decrease in the coherent information in a system. Since Information (F) is a component of intelligence, anything which increases entropy also decreases intelligence. Since each of the components of intelligence is a function of a structure which incorporates Information (F), to decrease any component of intelligence is to decrease Information (F) and to increase entropy.

Therefore, the entropy of a system is increased if its intelligence is decreased. Since a human society is an embryonic collective intelligence at the super metazoan level, based on psychosocial as opposed to biological evolution, we can estimate whether a human society is evolving or undergoing entropic decay by seeing if its collective intelligence, i.e., ability to predict and control the total environment, is increasing or decreasing respectively. If it is decreasing, then we know that that particular society is doomed to extinction because once an evolutionary entity begins to decay, it is on a one-way street to oblivion, as it was with the European Neanderthal and the Roman Empire. A constant increase in intelligence is a necessary but not a sufficient condition for a society to remain progressive. A

necessary and sufficient condition for society to evolve forever is that it constantly maximizes its collective creativity, as will be shown.

Distinct human societies, usually called "cultures," are the equivalent of differentiating species in human psychosocial evolution. However, so long as these societies can exchange cultural information, they are equivalent to interbreeding subspecies and they jointly occupy the top rung of the evolutionary ladder. This is also the case with the different interbreeding races of humanity who, because of their ability to interbreed, also jointly occupy the top rung of the evolutionary ladder. However, it is possible for a human society to be increasing its collective net intelligence along a specialized path.

As we have seen, when specialization occurs a species is doomed to eventual extinction, even if its specialized intelligence is actually increasing for an extended period. The dinosaurs of 65 million years ago and highly specialized mammals of 40 million and 14 million years ago are examples of this. The best way to detect this partial decay in a human society is to see if any of its eight gross components of collective intelligence is decaying. If one component is decaying, then the society must eventually decay even if its net intelligence is currently increasing. Specialization always involves the decay of one or more components of intelligence. Specialization of intelligence always decreases creativity when it results from a deliberate choice. For humanity, specialization decreases Will (W) by decreasing ethics.

As was indicated in the previous section, the components of collective human intelligence are a function of three underlying subsystems: (1) the number of intelligent individuals; (2) the collective knowledge and technology; and (3) the ethical code. This is analogous to early hominid intelligence, which was a function of the three major subsystems: (1) the nervous system for Will (W), Imagination (G), Logic (L), Memory (M), Information (F), and Connectors (N); (2) the eyes, ears, taste buds, olfactory membranes, etc. for Sensors (S); and (3) bones, muscles, skin, and organs for Effectors (R). Information (F) in all systems is whatever is received by the Sensors (S) or produced by the Imagination (G) and the genes. The major source of social entropy is that the system becomes specialized to avoid certain types of Information (F). Ethics are a uniquely human subsystem for preventing this.

Organic Ethics

Species below the human will automatically specialize to fill an ecological niche if such a niche is made available to them, because almost all subhuman species are genetically programmed to assimilate nutrients, survive, and reproduce—and nothing else. The law of natural selection operates automatically to increase intelligence and eliminate entropy by assuring the long-term propagation of the most intelligent, generalized species and the

eventual extinction, although it may take hundreds of millions of years, of the less intelligent and/or more specialized species. However, *Homo sapiens* is genetically programmed to do one more thing—to learn, teach, and, above all, to create.

To create is to systematically organize the total environment into new patterns which increase the net intelligence of the biomass. Learning and teaching are therefore a special type of creation where we reorganize our Information (F) and that of others. Creation is manifested in all invention. *Homo sapiens* is the only species today which systematically invents, although many species can innovate behavior. The earlier hominids also, obviously, invented. Although invention is only one aspect of the creative process, it is a necessary part of human evolution. Therefore, we will often use it as a surrogate for creativity in tracing the ethical evolution of humanity. We will show that the rate of invention is an objective indicator of the ethical state of a human society. Ethics are rules of optimal conduct which maximize the evolutionary rate of progress for the group adopting them. But ethics, like any other evolutionary subsystem, is subject to entropy.

Sometime early in hominid evolution, perhaps as long as six million years ago, a mutation occurred in the hominid brain which produced a need in our ancestors to create. This was the seed from which the purely human neocortex was to grow. Natural selection was a mechanism by which the seed was nurtured, but the seed itself was a choice made more probable by the particular ecological niche that the early hominids had chosen. The need to create would have had little or no survival value among a species devoid of manipulative dexterity and not dependent on invented tools even if, like the dolphins, it had a very complex nervous system. The need to create could neither be engendered nor express itself in a brain significantly more primitive than that of an early hominid, e.g., that of a reptile or a marsupial. Within the early hominids this need was an additional spur to evolution because it increased the rate of beneficial psychosocial mutation, i.e., the rate of invention.

The inventions of the earliest hominids were probably few and far between in number. The fossil and paleoarcheological evidence indicates that about four million years must have elapsed between the time of the earliest tool-using hominids and the crudely shaped stone tools of late Australopithecus and *Homo habilis*. For at least four million years our ancestors did little more than trim branches and select stones in their tool-making activity. Eventually some genius among our ancestors realized that the much more useful sharp-edged stones could be produced by deliberate chipping and that he/she was not dependent on mere luck for finding these stones.

The early hominids probably did not have a brain sufficiently complex to realize this fact through abstract reasoning alone. Instead, they had to engage in a creative process of research and development. There had to

be a need in these hominids to experiment by trial and error in modifying stones simply because it was fun. In this way they came to realize that systematic chipping would put an edge on the stones. This need to obtain new Information (F) from the environment by playful experimentation is an essential ingredient in the creative process. But it is not enough.

A chimpanzee also has the need to experiment with his environment. He will pick up new objects and take them apart to see what makes them tick. In controlled laboratory experiments, chimpanzees will repeatedly engage in complex problem solving without any external reward. The act of solving a problem is reward enough. Indeed, once chimpanzees begin to be rewarded for solving problems, they will lose their interest in problem solving when they are no longer rewarded [108]. This phenomenon occurs among many children. Extrinsic reward and punishment are destructive to the creative process. Therefore, the early hominids probably also had these characteristics since their brains and bodies were very similar to the chimpanzees. But they also had something else.

A chimpanzee will apparently not make a tool unless he has an immediate need for it [108]. Human beings will make many kinds of machines just because it is fun. This is clear just by watching very young children playing with blocks or building sand castles. This is a higher level of experimentation. One does not merely take things apart to see what makes them tick, but one puts things together into a new order to see what will happen. There is a close relationship between play and creativity. This is the key to the instinctive behavior which is uniquely responsible for psychosocial evolution and human ethics.

Each invention provides new Information (F) about the environment and makes persons who possess this Information (F) more intelligent. Once our ancestors began to invent systematically, they must have quickly learned that, along with being fun, creative activities increased their intelligence and the intelligence of those with whom they communicated. Thus, the embryonic instinct to learn, to teach, and to create became an integral part of our ancestors' psychosocial makeup, because it was a form of play.

The hominid families which were most predisposed toward creative behavior would generally have the best technology and would communicate this knowledge to their loved ones as a form of play. These families would, through natural selection, replace the less creative families. The evolutionary pressure on the hominids was for acquiring and communicating knowledge about the total environment, because for a generalized species like the hominids all aspects of the environment influenced their survival. Therefore, humanity has an innate need to predict and control its total environment. This need became as basic to our hominid ancestors as their needs for self-preservation and sex. Indeed, this need was in practice even more basic, because only by increasing their ability to predict and control their total environment could the hominids survive and reproduce at the expense

of their competitors. Therefore, the evolutionary ethic is genetically programmed into the human nervous system as a form of play as well as a duty. However, it is a recent programming of the neocortex. It will sometimes conflict with the long-established, deeply embedded emotional patterns of fear which are programmed into the primitive brain. It is the rare human being who goes against his/her strongest fears in order to fulfill his/her ethical needs. Yet ethical behavior was so essential to human survival that the later hominids created psychosocial machines to help amplify ethical resolve. These machines were then subjected to natural selection, as are all factors in the collective intelligence of humanity.

The amplifiers of ethics were psychosocial machines created by persons who dimly perceived the nature of their ethical needs. They knew that they wanted to understand, predict, and control the whole world around them in general and that part of the world which was dangerous and threatening in particular. Most of the natural phenomena they observed—lightning, floods, earthquakes, and, above all, death—were ultimately beyond their ability to predict and control. But humanity had a primitive emotional need to feel secure and a more recent need to predict and control as an end in itself. Humanity satisfied both needs with the machine of religion.

Religion

The earliest, clear, indirect evidence of religion among primitive hominids is found among the Neanderthals who, as was indicated, engaged in ceremonial burials, cave bear rituals, trepanning, and ritualistic cannibalism. There is some much more meager evidence that *Homo erectus*, who inhabited North Central China about 400,000 years ago, also practiced ritualistic cannibalism by frequently eating the brains but not so frequently eating the other, much more nutritious parts of the hominid body. In any case, once the hominid brain had reached the complexity approaching *Homo sapiens*, humanity was capable of abstract thought and abstract, purely psychosocial machines, such as religion.

One type of abstract machine is a psychosocial model of some aspect of nature. A model is a representation of events and their relationships and incorporates, by definition, Information (F). A doll is a concrete model of a person showing some correspondence with the superficial events and relationships which constitute a human being. A map is a two-dimensional concrete model of a three-dimensional part of the world. If it is a good map, it will have some correspondence with the geographic events and relationships which constitute this part of the world. A verbal description of a person is an abstract model of that person. A set of mathematical equations describing the geography of a region is an abstract model of that region. Religion is a model which seeks to describe the fundamental properties and purposes of the universe.

Religion is a model for explaining the unexplainable. All that humanity can neither understand nor accept is eventually explained by religion. Therefore, religion was at first concerned with explaining almost everything that humanity perceived, virtually all natural phenomena. The essential feature in a religious model is that it gives an explanation, that is, it subjectively claims to enable us to predict and control, but does not necessarily increase objective intelligence and may in fact decrease it. In other words, the essential core of religion is illusionary, subjective knowledge, although it may also incorporate real, objective knowledge.

What makes knowledge illusionary is not the fact that it is subjective, but rather the fact that it does not enable us to predict and control in the objective world. The only way we know that we know is when our alleged knowledge actually enables us to predict and control the physical, biological, and/or psychosocial environment. This is objective truth. When we incorporate false information which makes us believe that we can predict and control, but in fact does not permit us to predict and control any aspect of the physical, biological, and/or psychosocial environment, then we have illusionary knowledge and subjective truth.

Subjective truth is simply Information (F) which makes us believe that we have knowledge. It may or may not be illusionary. Objective truth is Information (F) which in fact does enable us to predict and control. The prediction and control may only be partial. Indeed it can never be truly complete. When we incorporate objective truth as a component of intelligence, it produces real knowledge. The foundation of religion is always subjective truth. Therefore, it is prone to produce illusionary knowledge and decrease intelligence. A religion is defined as an organized set of subjective beliefs, i.e., a subjective model, which claims to describe and/or explain fundamental processes and purposes of the universe and humanity's relationships to them. A "paradigm" is any similar type of model which may or may not also include objectively true beliefs. All religions are paradigms; not all paradigms are religions.

Primitive hominids would not have created religion if they were not ethical. They would not have been ethical if they did not value increasing their intelligence. The emotional need to increase intelligence, however, can be fulfilled simply by the subjective belief that one has knowledge. Therefore, although religions begin in an ethical attempt to create a coherent, true model or paradigm of the universe, including one's relationships to it, they easily become entropic systems which close the mind by convincing the believer that all the truly important matters are explained. Religions fail when they use a form of play as an antidote to fear. When we are driven by fear we always deceive ourselves. When this happens, the society which incorporates this religion as the basis for its ethical code begins to decrease its intelligence and it eventually becomes extinct.

Religion serves as a repository for the evolutionary ethic. Almost all

contemporary religions claim to value truth. Judaeo-Christian belief is replete with notions such as "God is truth" and "the truth shall make you free." In Zoroastrianism the most heinous crime, even worse than murder, is lying. The problem is that once a religion claims to have found truth, it closes its collective mind to the possibility it may be wrong and destroys the intelligence of its adherents. In other words, all religions have a central dogma which cannot be doubted. This lack of doubt destroys objective truth, decreases intelligence, and diminishes creativity. It turns play into punishment. Furthermore, this state of affairs is inevitable for all religions.

Any comprehensive model, or paradigm, of nature will have to be incomplete because the universe is an infinite, interconnected whole (as we saw in Chapter 1). We could not have absolute truth without infinite knowledge—which is an impossible event for any finite being. Even a complex collective intelligence made of billions of fully integrated, cooperative, individual human intelligences would still have finite knowledge. Therefore, all models have errors and must be modified even in their most fundamental assumptions. Our models of nature cannot evolve unless we doubt their validity. But the emotional need fulfilled by religion is that it offers us certainty in an uncertain and dangerous world. Religions become destructive when they are used to relieve fear rather than enhance the joy of play. When repetitive ritual rather than creative play becomes synonymous with ethical duty, the religion is destructive.

The Neanderthals were probably quite concerned about death. The thought that their egos would someday be extinguished was unbearable. So they apparently developed a religion which postulated a model of the universe in which there was a life after death, i.e., a model in which the individual intelligence produced by the interactive effect of the body subsisted after the body was destroyed. Therefore, the Neanderthals buried their dead with weapons and other tools which might be of use in the life after death. They also probably believed (with what we now know is good reason) that many of the essential qualities of a person were contained within his brain. However, they probably also had the subjective belief that these qualities could be transferred and preserved in the society by eating the brain of the dead person. As was previously mentioned, this practice exists today among the Papuans of New Guinea. It is the cause for the spread of the fatal brain disorder, kuro. It is also quite likely that the Neanderthals, like most primitive people today, believed in spirits which animated everything in the universe from the sun and moon to the giant cave bears and their own bodies. These beliefs were probably shared in great part by the Cro-Magnon and probably did not cause a significant decrease in collective intelligence, unless possibly the ritualistic cannibalism involved killing and eating the most honored member of the society in times of stress in order that the whole group could share his/her qualities. Religious practices similar to this existed among the Aztecs and, to a lesser extent, among the

ancient Vikings. However, many religious activities and rituals were clearly a waste of time which could have been more effectively used to cope realistically with the environment; their main function was to relieve fear through self-delusion.

There is a trade-off of advantages and disadvantages in religion. The advantages in religion are that it serves as a repository for a unifying ethical code that ties people together, engenders cooperation, and may even foster an increase in creativity by increasing both intelligence and ethics. We note that the word "religion" comes from a Latin word meaning "bind together." The creative side of religion is evidenced by the educational activities of the Catholic Church, Protestant missionaries, and other religions as well as the extreme creativity of the Renaissance that was in part intertwined with Christianity, e.g., the Reformation as well as the Sistine Chapel and the music of J.S. Bach. Religions also provide emotional tranquillity to persons by giving life a meaning and sense of purpose as well as by deluding its adherents into believing that they are coping with an aspect of nature which is currently not controllable by technology, e.g., earthquakes, disease, or death. As technology evolves, an ever greater part of the universe is truly controlled by humanity until religion is concerned almost entirely with predicting and controlling the mind or soul.

Religions may seek to predict and control the mind by not allowing the propagation of any information which is contrary to its model of the universe. This happened under Christianity and Islam. However, the most insidious and destructive aspect of religion is that it can make its adherents totally obsessed with predicting and controlling their own thoughts to the exclusion of objective reality. In the process they cease to invent and be objectively creative. Instead they become obsessed with what they call "the spiritual life." We have seen this happen in our own time to India, Tibet, the Islamic countries, and, to a much lesser extent, Spain. Spain is now reversing its mystical specialization as it becomes integrated with the rest of Europe. This is discussed in more detail in the next chapter. In another time, through the process of natural selection, these societies would be brutally and ruthlessly replaced by less mystically specialized and more technologically advanced societies, as has happened thousands of times in the past. In fact this is happening to Tibet now in a destructive manner as Chinese Communism (a secular religion) replaces all the ancient Buddhist traditions, not all of which were destructive.

The implications of religion and mysticism in the modern world are discussed in Chapter 4. For now, we merely note that religion has been a common key component of human society and mental evolution for at least 100,000 years. At the same time, it has been the main repository of both ethics and entropy for the human race. This paradox is due to the fact that religion is a manifestation of subjective ethics, which may manifest itself in an objectively valid ethical code.

Ethical Codes

Organically determined ethics are a function of the neocortex's genetic preprogramming, which compels us to explore, construct, learn, teach, create, and find joy in the process. This genetic program can be seen at work in young children who are naturally curious and try to learn as much as they can about everything. It is also manifested by the fact that very young children almost never lie, but feel compelled to tell the truth even when it is to their disadvantage. We have to learn how to lie. Truthfulness was clearly an essential component of creative human organization lest false Information (F) were to propagate throughout the group and decrease its collective intelligence. If members of the group could not trust each other's word, this would impede their ability to cooperate and further reduce collective intelligence as if the group had defective collective Connectors (N). Therefore, there was ever stronger evolutionary pressure for ethical selection once group hunting began.

Subjective ethics are rules of conduct we feel compelled to follow irrespective of their emotional effects, although normally they bring us joy. We will follow these rules even if they cause unhappiness and distress to ourselves or our loved ones. In some cases we may even follow these rules when we know that they could cause our death. No subhuman animal can behave this way. This is what is called the "Moral Sense."

Ethical behavior is a result of genetic programming which is amplified by an ethical code. The ethical code is sometimes verbally explicit, but it may also be incorporated into behavioral tradition. Insofar as the ethical code is objectively valid, it increases the creativity of the group, sometimes at the expense of individual intelligence. Natural selection provides for the multiplication of the progeny of the most creative group at the expense of less creative groups with ethical codes that are more at variance with the evolutionary ethic. The ethical code of a group is an objectively measurable machine analog of individual subjective ethics. This serves to amplify the collective creativity of the group just as subjective ethics amplifies individual creativity. As the human species evolves, its capacity for abstract modeling increases and the ethical code becomes incorporated into the religion of the group. The religion is the main repository of ethical rules of conduct. When these rules are based on false premises which decrease group creativity, then the religion becomes entropic and eventually leads to the group's destruction. However, these policies and rules of conduct are maintained because the adherents subjectively feel that they are ethical and either consciously or unconsciously believe that by following these rules they are increasing the collective creativity of the group.

Therefore, one way of looking at an ethical code is as a set of rules, not necessarily verbalized, which are subjectively perceived, consciously or

unconsciously, to increase the collective creativity of the group to which its adherents belong. Ethical codes evolved through natural selection among human hunting bands over a period of at least five hundred thousand years. Those codes which increased the group's collective ability to predict and control gave its members collectively higher fitness and were carried forward generation after generation by nongenetic inheritance. The fact that an ethical code increases group fitness is an objective criterion that it is valid. An increase in group, not individual, fitness is a necessary but not a sufficient reason for objective ethics. Objective ethics are the machine amplifiers of personal, organically determined, subjective ethics programmed into the neocortex.

The difficulty in giving the necessary and sufficient reasons for an objectively ethical code of conduct stems from the fact that ethics are relative. Identical behavior under different circumstances is not always ethical. For example, one ethical imperative that must have been part of all viable human groups was that of mutual nurturing and protection of members of the group. However, when a member of the group became destructive to the welfare of the group through pathology or by abandonment of the group's ethical code—e.g., a person who murdered members of the group in order to take their food, tools, or mates as means of enhancing his personal welfare—then the nurturing and protection of that person would have been destructive to the collective creativity of the group. Therefore, all viable ethical codes had to have a set of rules which when violated would automatically ostracize from the group any violator. For example, there is no working ethical code among any known group of humans which tolerates opportunistic murderers in their midst. Therefore, all ethical codes have evolved provisions for determining who can be and who cannot be a member of the group. These provisions always produce pressure to conform to established norms. Inventive, creative behavior is by its very nature nonconformist. Therefore, there is a trade-off between the rigidity of the ethical code and the creativity of the group.

An extremely rigid ethical code produces a high degree of group cohesiveness and mutual supportiveness, but it impedes creativity. This produces a collective intelligence with excellent Connectors (N) and a strong Will (W), but a weak Imagination (G). Furthermore, if the ethical code is largely subjectively determined and incorporates irrational patterns of behavior—such as taboos against exploratory and inventive behavior (these exist among the Australian aborigines) [30]—and/or if the ethical code demands a considerable expenditure of energy in nonevolutionary, ritualistic behavior (for example, the building of enormous tombs and other elaborate preparations for life after death), then the ethical code will eventually impede the capacity of the group to compete against a less rigid and wasteful group.

The fact of the matter is that up to now ethical codes have not evolved

in a conscious, deliberate effort to maximize group creativity. They were more analogous to random psychosocial mutations and were subjected to brutal natural selection in ethnic and later religious wars. Religions often represent a type of psychosocial specialization which increase entropy by closing the collective mind of the group to contradictory models. Therefore, religions which evolved in more progressive cultures represent radical psychosocial mutations within the group that are imposed by revolutions. Religion is a psychosocial bond which is a more tenuous extension of the sexual and group hunting bonds of primitive hominids. A rational, objective system of ethics can serve the same purpose.

Objective Ethics

Objective ethics are a way of forming an ethical code which can continue to evolve without closing the collective human mind. By seeing ethical behavior in its evolutionary perspective we can determine objective criteria of optimality by which to judge whether an action is good or evil. Survival may appear to be such a criterion. But survival is more a constraint, or better still, a consequence, of ethical behavior rather than the prime criterion of optimality.

Optimality refers to the extremal (a maximum or a minimum) of a process in a desired direction. The direction of evolution is clearly toward ever greater intelligence through increasing complexity. Creativity is the most generalized form of intelligence. The complexity of a system is directly proportional to the number of its individual components and the number of the interconnections between the components. As has been shown, specialized complexity is increasingly unstable and eventually becomes entropic. Only generalized complexity and intelligence continue to evolve. Objective ethics are therefore generalized rules of conduct which when followed maximize over time the collective creativity of a group.

Beings are ethical if and only if they can predict and control their own ability to predict and control. Beings behave ethically if and only if they subscribe to an objectively ethical code. An unethical being is any being who systematically diminishes the creativity of any person or group.

An ethical code, if it is to be intrinsically self-consistent, must limit membership in the group to ethical persons and expel unethical persons, since unethical persons are by definition destructive to the group's intelligence. Intelligence itself can be used to (1) increase intelligence through creativity or (2) decrease intelligence through destructiveness. Unethical intelligence is intelligence used to diminish intelligence; it is a type of psychosocial parasitism exemplified by human beings who prey on other more creative human beings. Ethical intelligence is synonymous with creativity. It is intelligence used to increase intelligence; for example, human beings who learn, teach, and create but do not destroy. Creativity is the highest

form of intelligence. From this follows the evolutionary ethic which must form the criterion of optimality for any objectively valid system of ethics:

Each person must do his or her best to maximize creativity.

It seems that all known ethical systems incorporate the evolutionary ethic intrinsically by having taboos against certain types of specific behavior which would violate the ethic, e.g., murder and lying, and, much less often, exhortations to perform certain specific acts which would agree with the evolutionary ethic, e.g., to be industrious and to help those less fortunate than themselves. Therefore, all ethical codes claim implicitly or explicitly to increase intelligence and creativity. The problem arises when they incorporate false religious models which are subjectively ethical but objectively unethical.

Objectively we can determine the validity of any ethical code by its fitness. Since ethical codes, like all other aspects of humanity, are subjected to natural selection, those codes which survive the longest and are incorporated into the cultures with the greatest numbers of creative persons must be those which are in closest correspondence to the evolutionary ethic. In order to see that this is the case, we must first derive specific ethical principles from the more general evolutionary ethic.

Ethical Principles

As we have seen, ethics are relative insofar as specific acts are concerned, since the same specific behavior, such as shooting an arrow, may be ethical in one context but unethical in another, e.g., (1) killing wild game to be shared by the group or (2) murdering an ethical member of the group, respectively. Ethical principles are a code of conduct which is sufficiently general to apply to all possible situations, but which is still more specific than the evolutionary ethic. Any valid ethical principle must be shown to always increase at least one component of the collective ethical intelligence of the group and never decrease any component of collective ethical intelligence. Recall that creativity is synonymous with ethical intelligence. The collective creativity of the group is a function of the individual intelligence of its members, their collective ethics, and the set of all their technology. Their ethical code may be considered to be a function of their individual intelligence and collective knowledge. There is a constant interaction between the ethical code and all the other components of intelligence.

The ethical code is a unique machine which amplifies the Will (W) in the evolutionary direction. This is the only known machine which amplifies this component of intelligence. The human Will (W) is itself already genetically programmed in the ethical direction by the neocortex. Therefore, when we speak of amplifying innate human ethics, we merely mean the amplification of the Will (W) in the evolutionary direction.

We have now given examples of machines which amplify all the components of intelligence except Imagination (G). The amplification of Imagination (G) is extensively discussed later on. For now we note that Imagination (G) is diminished by the closure of mind that results from any type of specialization. Imagination (G) will be amplified by a machine which makes the total knowledge of the group available to each individual member in an integrated, coherent manner. The theory of creative transformation and its applications being developed in this book are machines to amplify Imagination (G).

The Will (W) is the component of intelligence which gives evolutionary direction to a species. The Will (W) is a vector whose direction determines what the organism will predict and control and whose magnitude determines the resolve to maintain this direction and act purposefully. Evolutionary ethics amplifies the Will (W) in the direction of the Moral Sense, namely, that of maximizing generalized, ethical intelligence. The ethical code is a psychosocial group analog of personal Will (W) used as an amplifier of the Moral Sense. The Moral Sense is the genetically programmed need to increase ethical intelligence. The ethical code, when it is in correspondence with the evolutionary ethic, gives the collective Will (W) of the group the direction of maximizing general, collective ethical intelligence. Creativity and ethical intelligence are equivalents in the sense that $C = IE$, where C = creativity, I = intelligence, and E = ethics. From this observation, we can deduce *eight general ethical principles* which form an objective, evolutionary ethical code. Such a code clarifies what we mean by "good" and "evil." They are as follows:

1. Only actions or persons which increase creativity are ethical. [This is the meaning of "good."]

2. Any action or person which decreases creativity is unethical. [This is the meaning of "evil."]

3. Unethical means can never achieve ethical ends.

4. Means which are not ends are never ethical.

5. It is unethical to tolerate destructiveness.

6. It is unethical to be certain.

7. It is ethical to doubt.

8. Inaction is unethical.

These principles follow logically and scientifically from the evolutionary ethic. We will state these ethical principles as theorems and present heuristic arguments for and examples of each principle.

First principle

Only actions or persons which increase creativity are ethical.

This follows directly from the evolutionary ethic and the definition of "ethical." In general, a person is behaving ethically during a given period of time if and only if the net effect of his/her actions during this period is to increase creativity. If a person increases no creativity other than his/her own, and he/she does not decrease creativity for any other person, he/she has been ethical but not necessarily optimal, unless the other ethical principles which follow have also been satisfied.

Second principle

Any action or person which decreases creativity is unethical.

From the first principle it follows that since only actions and persons which increase creativity are ethical, then any action which decreases creativity is either unethical or trivial.

Definition: An action or person is trivial if and only if it does not affect creativity positively or negatively.

Every action and person is either ethical, unethical, or trivial. Therefore, the second principle follows from the first and from the definitions of ethical, unethical, and trivial.

If a person decreases creativity for any person including himself/herself, then he/she behaved unethically. A person may behave both ethically and unethically during a given period. A person is ethical if the net effect of all his/her actions is ethical, i.e., his/her ethical acts outweigh his/her unethical acts. A person is unethical if the net effect of all his/her acts is unethical, i.e., his/her unethical acts outweigh his/her ethical acts.

Definition: A person is moral at time t if and only if all his/her future acts after time t are ethical.

Definition: A person is immoral at time t if and only if all his/her future acts after time t are unethical.

Observation: The set of all trivial acts and persons is a set of measure zero, i.e., almost all acts are either ethical or unethical. (See Glossary and pp. 125–26 for how these concepts relate to Equation 3.1.)

Third principle

Unethical means can never achieve ethical ends.

From the second principle we have that an unethical means is any means which decreases creativity. From the evolutionary ethic and the first

principle we have that the only ethical end is to increase creativity. Since one cannot increase creativity by decreasing it, unethical means can never achieve ethical ends. This means that it is unethical to attempt to increase the creativity of a group, no matter how large, by decreasing the creativity of even one person.

This principle probably became adopted into ethical codes through natural selection when early groups violated it by cannibalizing their fellows in times of famine. Those groups in which nutritive cannibalism of ethical members was practiced had less fitness than those groups which did not have this practice, but did their best to care for *all* members of the group. The fossil evidence indicates that cannibalism was widely practiced among primitive man; however, almost no viable society in recorded history had this practice. Those that did, such as the Aztecs, almost always limited this practice to prisoners of war, and were themselves eventually subjected to total conquest by noncannibals.

A variation of cannibalism was the much more widespread practice of religious human sacrifice among many ancient civilizations throughout the world. These ranged from the Philistines and ancient Hebrews of 3,000 years ago to the Vikings and Mayans of 1,000 years ago. This was also a violation of the third principle, which indicated a high degree of entropy in these cultures, which in turn made their replacement by cultures not practicing human sacrifice inevitable.

In modern times we have seen the violation of the third principle by societies which practice slavery. Slavery is analogous to slow-motion cannibalism in that a human being is consumed by forced work. Inevitably these societies will destroy their imagination through slavery, which is a type of psychosocial specialization, and fall prey to societies which use machines and not slaves to amplify individual intelligence. We saw this in the eventual domination of the slave-based Islamic civilization by the technology-based civilization of Western Europe, even though Islam had at one time been more technologically advanced and far wealthier than Christian Europe. The same thing happened between the slave-based southern United States and the technology-based northern United States in 1865. The United States is still suffering today from having tolerated slavery for "four score and seven years."

The economic and social problems of communist countries, which do not allow their citizens to emigrate on demand, thereby making them de facto slaves, can be traced to their violation of the third ethical principle. Another example of unethical means failing to produce ethical ends was in the Nazi use of concentration-camp victims in medical experimentations. Although thousands of experiments were done, no useful knowledge came from these experiments.

Observation: All ethical persons belong to the same group.

Corollary: A corollary of the third principle is that, other things

being equal, the more tyrannical societies will by-and-large be dominated by the more libertarian societies. For this reason, in every major war of the last 200 years, including the cold war, the freer side has won. Right makes might. It is right, i.e., ethical, to maximize the creativity of every person (E.P. 1). It is always wrong, i.e., unethical, to diminish the creativity of any person (E.P. 2) for the benefit of any other person or group (E.P. 3). Any unethical act must always lead to the decrease in the net creativity of the person committing the act and/or the group sanctioning or tolerating the unethical act. That is why the communist countries cannot catch up in creativity or wealth to the western democracies, although their monolithic control and size makes them appear militarily formidable. They must become more libertarian, or die. The ends do not justify the means.

Fourth principle

Means which are not ends are never ethical.

Since the only ethical end is to increase creativity, means which are not ends are any means which do not directly increase creativity. Such means can only be unethical or trivial. If an act is unethical, we know from the third principle that it is inconsistent with any ethical end. If an act is trivial, it follows from analogy, and from the fact that trivial acts are a set of measure zero, that it can at best achieve only trivial ends. Therefore, means which are not ends are never ethical.

In other words, a means is ethical if and only if it is an ethical end in itself, i.e., if and only if it increases creativity directly. Persons or societies which use any means which do not directly increase creativity will as a consequence increase their entropy. This was previously shown to be the case for unethical means. In the case of trivial or apparently trivial means, we see this in the practice of religious rituals which do not seem to directly harm anyone but have no logical or scientific connection to the problem at hand. The building of huge tombs devoid of esthetic merit for conducting its occupants to a nonexistent afterlife represented an enormous but trivial expenditure of energy by the ancient Egyptians that could have been ethically used to build dams, aqueducts, schools, and military defenses. This trivial preoccupation with life after death, besides wasting the energy of creative people, in time led to a death-oriented civilization no longer creative and subject to conquest by succeeding waves of Hyksos, Hittites, Libyans, Persians, Greeks, Romans, and Arabs until almost no trace of the original civilization remained—not its language, writing, religion, or customs. Only archaeological ruins remained.

It should be emphasized that religious structures are not entropic in and of themselves, but only when they represent a waste of energy and provide no social benefit. The cathedrals of Europe served as means of

organizing and unifying primitive groups of Europeans who had sunk into barbarism. They were inspirational public meeting places. More importantly, the cathedrals were artistic and technological masterpieces which, like all art forms, expressed the unconscious synthesis of the collective ethical intelligence of Europe. The religious shrines and trivial customs, e.g., repositories for miraculous relics and dietary laws respectively, which were to be elaborated within the Catholic Church, were basically entropic and were not to be kept in the more progressive forms of Christianity typified by the Protestant sects of northern Europe.

All forms of compulsive, repetitive behavior which have no current relationship to creativity increase the entropy of the individual and the group. This ritualistic behavior is not confined to religions but may include the ritualistic behavior of spectator sports, as well as many of the "social graces."

As a final example, consider the willingness of devout Moslems and Hindus to starve rather than eat proscribed pork or beef. In the case of some Moslems and Hindus, their dietary laws, which originally may have had a public health or other social function, have become entropic ends in themselves, and the original ethical ends have been lost to trivial means. It is in the nature of humanity that the means eventually become the ends. Only means which are ethical ends in and of themselves will have survival value and serve evolutionary purposes. Only means which directly enhance our ability to learn, teach, and create are ethical.

Fifth principle

It is unethical to tolerate destructiveness.

Since (1) the evolutionary ethic directs us to maximize creativity, (2) destruction is the decrease in anyone's creativity, (3) creativity cannot be increased, much less maximized, by allowing it to be diminished (E.P.'s 2, 3, & 4), and (4) we are an interconnected, interdependent species in the process of creating a collective ethical intelligence at the super-metazoan level, then the decrease of creativity for any one person decreases it for the entire species. Furthermore, the second law of thermodynamics states that entropy must increase for any closed system. The decrease of creativity for even a single ethical individual represents a closing of the collective mind of humanity. Unless it is forcefully overcome, entropy can spread without limit and bring the human species to extinction, just as it has caused the extinction of thousands of specialized species in the past. Therefore, it is unethical to allow creativity to be decreased because to do so is to violate the evolutionary ethic.

Historically, any society which tolerated destruction in any way was sowing the seeds of its own extinction by increasing its own entropy. For this reason, almost all progressive cultures have had strong admonitions

and sanctions against murder, stealing, lying, and other destructive acts because destructive acts decrease the creativity of the individual and, consequently, of the society. However, virtually all societies have been prone to a more subtle form of self-destructive behavior, one which stems from seeking to prevent the dissemination of information concerning their own weakness.

This is usually done for the alleged purpose of denying this information to its enemies, but in the process important information is also denied to its ethical members, and misleading, optimistic information about weaknesses of the society is put in its place. Since information is a prime component of intelligence, misleading information will diminish creativity for the individual and the society so that corrective action will not be taken and entropy will increase. Therefore, closed, secretive societies are likely to become extinct, while open, free societies are likely to grow and multiply. Thomas Jefferson's swearing of "eternal hostility against every form of tyranny over the mind of man" is grounded on sound evolutionary ethical principles. The success of the United States, Western Europe, and other relatively open democratic societies over more closed, secretive, and despotic societies during the past 200 years is further empirical evolutionary evidence that it is unethical to allow creativity to be diminished for the individual or the society.

Sixth principle

It is unethical to be certain.

Once a person or society is certain about any cause-and-effect relationship, that person or society has resolved that he, she, or it has nothing more to learn about that subject. Since the universe is apparently an infinite, interconnected whole, as was indicated in Chapter 1, and our knowledge is always finite, it is objectively false to presume that we have complete knowledge on any subject. Therefore, a state of certainty precludes further knowledge and the maximum expansion of creativity. Certainty represents a closing of the mind, which is a prelude to irreversible entropy. Furthermore, persons or societies which are certain that they have found truth will tend to be intolerant of persons who question that truth and search for more knowledge in that particular subject area. This will cause a decrease in creativity in violation of the second principle. Therefore, it is unethical to be certain.

Corollary: Because it is unethical to be certain, any person or society which persecutes an individual or a group because it believes that they are unethical and are, as a consequence, diminishing creativity, will risk destroying its own creativity. Therefore, a more ethical alternative for a group is to expel its alleged unethical members by exiling them instead of

killing or imprisoning them, which might destroy creativity. By exiling alleged unethical members, a society only risks losing a source of knowledge for itself and slows down the evolutionary rate if its judgment is mistaken; it does not destroy this knowledge for the entire species. All judgments must be tentative. We should try to avoid any act which might result in irreversible damage if our judgment is in error, although it is better to act decisively than not to act at all. In general we judge acts, not persons.

Seventh principle

It is ethical to doubt.

Since it is unethical to be certain, it is either trivial or ethical to doubt. Since, by the argument given in E.P. 6, (1) it is not possible to learn unless one has doubts because our minds become closed to new knowledge in the absence of doubt; and since (2) learning is always ethical and never trivial, doubt is ethical and not trivial. Therefore, it is ethical to doubt.

Historically we see that persons and societies which have questions about nature are those that learn about nature. Those that have no doubts about any cause-and-effect relationships can not learn about that subject.

We see that the effects of suppressing Galileo's doubts about the sufficiency of the Ptolemaic model of the universe by the Catholic bureaucracy, which officially had no doubts, caused a drastic decline in scientific and technological creativity in the purely Catholic countries of southern Europe relative to the countries of northern Europe which were not subject to Catholic authority. Note that up to this time the southern European countries had been more creative in science and technology than the countries of northern Europe. If they had serious doubts about their ideology, the Inquisition would not have burned hundreds of thousands of heretics, the Communists would not have killed tens of millions of dissidents, and the Nazis would not have slaughtered millions of Jews, Gypsies, Slavs, and other alleged "inferior races." If they had doubts, Catholics and Protestants would not still be murdering each other in Ireland, and Moslems and Hindus would live in peace in Asia. Throughout history the absence of doubt has been a prelude to irreversible entropy and destruction.

The scientific revolution of the last 300 years was based on abandoning the authoritative certainty of religion and substituting for it the principle of doubt. Modern science, which has done more to increase the intelligence, not necessarily the ethics, of humanity in the last 300 years than religion did in over 100,000 years, is based on the principle that all models of cause-and-effect relationships are to be assumed probably false until proven true by repeated, controlled, independent experiments. Even then a scientific model is considered not as absolutely true and beyond all doubt, but only as tentatively and relatively true until a better model comes along

which better enables us to predict and control. The conservatism and skepticism of science are based on the fact that it is much easier to formulate convincing, apparently logical models which are false than to formulate models which are true. It is ethical to doubt.

Eighth principle

Inaction is unethical.

Evolution is not possible without action. We know from the second law of thermodynamics that entropy must increase in a closed system. What keeps a system open is purposeful ethical action. At first this action is physicochemically caused, then it is biologically caused, and finally it is ethically caused. Before the onset of ethical behavior, natural selection operates in a largely automatic but not totally deterministic way, as we shall show in Chapter 5. No known subhuman species can make the deliberate choice to evolve or not to evolve, although all species can make choices which affect their evolution. Only ethical species can make this ultimate choice. Only ethical species can deliberately commit suicide. But because of the second law, merely doing nothing is enough to enable entropy to destroy the human species. Creativity either is forcefully expanded or it is destroyed by inaction and entropy. Since the evolutionary ethic is that we must each do our best as individuals and as a species to maximize creativity, we will clearly fail in our ethical purpose if we take no action. Therefore, inaction is unethical.

Historical Perspective

So long as humanity was subjected to the brutal and unavoidable natural selection of prehistory, individuals and groups could not avoid action without quickly becoming extinct through the actions of predatory animals, other competitive human groups or the forces of nature in general. Therefore, humans who were not disposed to ethical action quickly died and left few or no progeny. However, the advent of civilization made it possible for growing numbers of parasitical human beings to live from the ethical action of others. At first these human parasites were limited to small, hereditary aristocracies and nobilities which exploited large numbers of peasants, artisans, and slaves, but produced nothing of value themselves.

When one group of persons obtained absolute military control over others, they could enslave them *de facto* or *de jure*. Before the advent of rudimentary civilization these captives were either cannibalized or merely killed, since they were considered of no value to the conquerors except as food and they would have been an economic liability to a hunting band, except possibly for some of the women. With the advent of agriculture and the formation of large groups with many specialized tasks, it became

socially feasible to exploit captives economically. The act of living parasitically off the ethical actions of others eventually destroyed the hereditary nobility either by removing all evolutionary pressure for ethical action or by turning them into a highly specialized, uncreative group of militarists and administrators. At this point the civilization would be conquered by a more ethical, less specialized, more active group. And the cycle would be repeated.

Every time that a civilization was conquered by a more ethical albeit possibly more primitive group, new vitality would be introduced into the culture, and there would follow a period of invention and development, thereby taking humanity one more step up the evolutionary ladder. "Primitive" in this context refers to a significantly lower content in extragenetic information. This happened when the primitive Hellenes conquered the decaying Minoan civilization and created classical Greece. It happened when the primitive Goths and Huns conquered a degenerate Rome and created Western civilization. Sometimes the great civilization would become expansionistic, such as the ancient Persians, Greeks, and Romans, and they would spread their knowledge to a more primitive people by conquest. But always there would develop a parasitical ruling class which was uncreative and inactive, and eventually the entropy of the leadership would lead to the downfall of the society.

This same process is going on today wherever societies are run not by entrenched nobilities but by entrenched, inactive, uncreative bureaucracies which consume the creative resources of the society and increase its entropy. This phenomenon is discussed at length later on. For now we merely note that any time that a society is ruled by an inactive elite, whether it be an elite of degenerate warriors or an elite of bureaucrats, the society as a whole becomes inactive, uncreative, entropic, and eventually extinct. The evolutionary progress of a society depends on ethical action. Inaction is always unethical.

If human evolution is to continue, action must be taken by the society as a whole and by individuals. A society becomes entropic only because individuals become entropic and refuse to take ethical action when they see the leadership violating ethical principles. A society in which even a small minority actively practices the Eight Ethical Principles cannot become entropic. Even if the society is conquered by a more intelligent but less ethical group, ethical action will assure that the most ethical group will survive, and it will transmit its ethics to its conquerors, who will become their allies and not their enemies. We have seen this historically in the two most ancient groups which had been guided by an ethical code which was in substantial harmony with the evolutionary ethic, namely, Confucianist China and the Jews.

These people have been repeatedly conquered, yet they have maintained their basic ethical code and their identity for thousands of years. The Chinese have absorbed every conqueror of the last 2,500 years and eventu-

ally made a Confucist out of him. This will probably even happen to the Communists. The Jews have spread the essence of their basic ethical system through personal creative example and through Christianity and Islam, which are mutated versions and psychosocial hybrids of Judaism created by a long series of conquerors of the Jews.

What makes it difficult to conquer, as opposed to defeat by force, a people with an ethical code in harmony with the evolutionary ethic is that each person can take ethical action alone without having to be told what to do by a higher authority. If an ethical person regards any authority as engaged in unethical pursuits, he/she must refuse to cooperate with it even at the cost of his/her own life, since to cooperate in any way with an unethical group or person is to violate the third and fifth Ethical Principles. If an ethical person sees someone's creativity being diminished, he/she will go to the person's aid against his/her unethical oppressor. In everyday actions an ethical person will seek to learn, teach, and create to the best of his/her ability. A tyrannical oppressor cannot control an ethical person but only kill or imprison him/her (e.g., Sakharov & Solzhenitzyn). A highly ethical person will die before being enslaved, and he/she will speak what he/she believes to be true even at the risk of his/her own life. Therefore, a militarily stronger foe can only kill ethical people and not effectively prevent the flow of information and the growth of knowledge among them. Human societies which have ethical bases will, as a consequence, endure when others perish or are absorbed by an unethical civilization.

When the succeeding waves of military invaders found this behavior among Confucist scholars, they killed them in great numbers but eventually succumbed to their ethical power. When Egyptians and then the Babylonians found they could not control their Jewish captives, they eventually gave up trying and let them go their own way. The Romans tried to get rid of their Jewish problem by destroying the Jewish center of worship and scattering them throughout their empire. In the process they became ethically infected by the same people they were trying to destroy when the Roman Empire was in turn conquered by Jewish ethics through Christianity and later through Jewish creative example.

The survival value of Judaism and Confucianism is objective evidence that there must be a correspondence between these ethical systems and the evolutionary ethic. The interactions between the evolutionary ethic and human evolution can be analyzed in terms of those forces producing civilization. But there is another concept related to ethics, which is also important for civilization. This is the concept of "decency."

Decency

Decency and ethics are different concepts which tend to be confused by individuals as well as civilizations. Ethics are optimal rules of behavior

which maximize creativity. Decency is a type of behavior in which a person (1) does not enhance his/her welfare at the cost of someone else's welfare, and/or (2) may sacrifice some of his/her welfare for someone else's welfare, such that their combined welfare is maximized. The more ethical a person is the more decently he/she will behave. This follows from the third and fifth Ethical Principles in the first case and from the first principle in the second case. However, it is possible for a person to appear highly decent and still be unethical. This occurs when a person regards happiness as being synonymous with human welfare.

Recall that happiness is a state of mind in which we believe that our strongest desires are being fulfilled. The more ethical a person is the stronger is his/her need to maximize creativity so that eventually only activities in harmony with the evolutionary ethic will make him/her happy. For such a person ethics and decency are synonymous, because for him/her "welfare" is synonymous with creativity.

An unethical person may, however, seek happiness in ways which do not increase creativity at all and may in fact decrease it, e.g., a drug user, an opportunistic murderer, or a rapist. The last two examples are indecent, unethical persons. An unethical, decent person is one who sees "welfare" as being synonymous with "happiness." He/she is perfectly willing to sacrifice creativity for himself/herself or others in order to make persons happy. This may be done by self-deception, by telling persons comforting lies, or by avoiding telling them unpleasant truths. It may involve sacrificing his/her own creativity in order to support a parasite with irreversible entropy, e.g., blind loyalty to a destructive leader or authority figure. (A human parasite is one who during his lifetime consumes more than he creates.) These types of behavior, particularly the latter, are often regarded as decent and indeed ethical by many persons and societies, but they violate the evolutionary ethic, since they do not maximize ethical intelligence and may in fact decrease it. This is clearly the case for any type of lying, since the incorporation of false information will decrease a person's ability to predict and control. By avoiding telling a person an unpleasant truth, we are not doing our best to increase his ability to predict and control. By supporting a parasite with irreversible entropy, we are at best wasting resources on trivial activities. These resources should be used to learn, teach, and create as best as we can (e.g., in better providing for young children) if we are to maximize ethical intelligence.

Traditionally societies have refused to support useless parasites with no evolutionary potential. This was so even with such highly civilized societies as classical Greece and China, where it was a parent's civic duty not to nurture highly defective children. It is only in very recent times, when the materialistic ethic and the Christian ethic encouraged the equal distribution of all wealth independently of merit, that large numbers of parasites began to be nurtured and, indeed, subsidized in their reproduction.

We may summarize the nature of decency as follows:

Unethical decency is a process for making others happy by denying them negative feedback; creativity is increased if and only if it does not cause unhappiness.

Ethical decency is a process for maximizing creativity independently of who is made happy or unhappy by our actions.

NOTE: All Moral Persons are always decent.

All Ethical Persons are predominantly decent.

All Indecent Persons are unethical.

Not all Decent Persons are ethical.

Because negative feedback makes everyone except highly ethical persons unhappy, and human beings have a strong, innate need to be happy, every human society in history has eventually destroyed, or is in the process of destroying, itself by eliminating essential negative feedback. We will go deeper into this subject in Part II. The question that comes to mind now is, Why should anyone bother to be ethical or decent if he/she can otherwise be happy?

The Game of Life

Happiness is clearly a fundamental value. It is almost axiomatic to many persons that being happy is the only purpose of life. Indeed some persons will say that it is impossible for human beings to choose anything except that which will make them most happy now or in the future. The most that we can hope for is that persons will engage in delayed gratification and recognize that ethical action is what makes us happiest in the long run.

These are not easy arguments to counter. We begin by first noting that happiness and creativity are not mutually exclusive, although neither are they the same thing. Happiness is a subjective state of mind—an experience. Creativity is an objective action which changes ourselves and/or others and makes us collectively more intelligent. If we value creativity, being creative will, by definition, make us happy. However, it is possible to be happy without in any way being creative, in fact by being destructive through, for example, drugs, self-delusion, and for some through sadomasochism. We choose consciously or unconsciously the values by which we organize our life. If we choose happiness, we may be happy for a time, but ultimately it will lead to an empty, meaningless existence in which we constantly search for new ways to be happy as we satisfy all our desires. Ultimately the desire for desire becomes our overwhelming need and we end up frustrated and unhappy. The pursuit of happiness as an end in itself leads to unhappiness. Happiness is a self-contradictory goal.

Ironically the only persons who are never unhappy are those who are fully committed to maximizing creativity, because this is an infinite desire which we can always be in the process of satisfying and which will always make us happy. To choose to maximize creativity will maximize both creativity and happiness. However, if we have truly made this choice, the happiness that results is merely a trivial side effect which we do not value. To choose to maximize creativity is an ethical choice which changes us forever. We then consider less and less our or anyone else's happiness in every choice we make.

The question then becomes, Can we really make choices? Are we not bound in fact by deterministic laws? Is free will not, in fact, an illusion? Schopenhauer said: "We can always do as we will but we can never will as we will." Each of us is born to parents we did not choose in an environment we did not make. Every action we take, every choice we make, seems to be determined by the circumstances of our heredity and our environment. Therefore, free will may be an illusion. In the fifth chapter, "The New Synthesis," we will examine quantum mechanical reasons why free will may not be an illusion. There is, however, another way of looking at life which enables us not only to surmount the pessimism and fatalism of determinism but also to act creatively and purposefully in our life. This is by looking at life as a game.

Life is a game in which we are both the pieces and the players. As pieces we are subjected to the determinism of the laws of nature as they alter our structure and impinge upon our body, brain, and mind. As pieces our actions are determined by events outside of ourselves. As players we partially determine our actions and modulate through our intelligence all the forces that act upon us. Through our creativity we alter the environment to suit our purposes. Whenever we are creative we are a player and not a piece in the Game of Life. Furthermore, the more we play the Game of Life the more we become players and the less we remain pieces. Eventually all players of the Game of Life begin to interact and to jointly maximize their intelligence and knowledge so that the universe is ever more under their control instead of it controlling them. Asymptotically, if we play the Game of Life, we become purely players and no longer pieces. Therefore, the Game of Life is a process that makes us ever freer as it makes us ever more creative. But we are never completely free, any more so than we are ever infinitely creative or infinitely knowledgeable. To grow forever in freedom and creativity as a species and to live on in the creativity we engender in others is enough to make some of us want to play the Game of Life. From these considerations, the evolutionary ethic, and the patterns of evolution we can derive the rules of the Game of Life.

Remember, this is a game which anyone may choose to play or not to play. That is the ultimate freedom we have—to choose to play or not to play the Game of Life.

RULES OF THE GAME OF LIFE

1. Each player must assume that he or she always has free will and is totally responsible for all of his or her acts and whatever happens to him or her.

2. Each player must do his or her best to make those choices and take those actions which will maximize creativity within the universe and to ignore all other considerations.

3. Each player must start the maximization of creativity with himself or herself.

4. Each player must eventually begin to think less about himself or herself and to seek to help maximize the creativity of others—this will in fact maximize his or her own creativity.

5. Each player must always remain open to the possibility that there are always an infinite number of alternatives by which he or she could have increased creativity more and that the universe may be structured very differently than he or she perceives it.

6. Each player should expect no other reward from playing the Game of Life than to have increased the creativity of others who play the Game of Life; this is what we win.

7. Everyone who plays the Game of Life wins.

8. Everyone who refuses to play the Game of Life loses.

Human progress is engendered entirely by persons who play the Game of Life, although some play it better than others. Our Game-of-Life proficiency depends not so much on our intelligence as on our ability to overcome our natural desire for happiness and replace it by our just-as-natural desire for creativity, which in fact maximizes our happiness. Most of us can never completely give up our desire for happiness. This is what makes us unhappy as we play the Game of Life. Ultimately we achieve happiness by not pursuing it. We win the Game of Life by playing it as best we can, not by being perfect at it. Only total refusal to play the Game can defeat us.

No one plays the Game of Life without choosing to do so. Those who choose to do so live on in the creativity they engender in others. Those who refuse to play the Game of Life become extinct.

The Game of Life is the collective implementation of the evolutionary ethic which makes us ever freer and in control of the future. Civilizations are collective attempts to get others to play the Game of Life and to have a vision of the future that is not determined by the past. When we play the Game of Life each ethical action determines a new future. Each creative action is an unpredictable, nonpredetermined, quantum event that is a result of a choice freely taken. The ultimate choice we have in life is whether to play or not play the Game of Life. No one can prevent us from playing or defeat us in the Game of Life. We can only prevent and defeat ourselves.

CHAPTER 4

Civilization and Ethics

It is commonplace to say that what made civilization possible was the invention of agriculture; but even more fundamental than agriculture were ethics. For only through ethics is it possible for large groups of people to live together. Agriculture was clearly necessary to support a large, sedentary population, but there would have been no significant grouping of cooperative people to invent agriculture if they did not have a unifying, objectively valid ethical code to begin with.

Civilization begins, therefore, not with the invention of agriculture about 10,000 years ago, but with the articulation almost 50,000 years ago of a valid ethical code which was incorporated into the religions of Cro-Magnon and other *Homo sapiens*. Those societies which lived in closest harmony with the evolutionary ethic would be the most cohesive, inventive, and dynamic. This would enable them to group together into the largest cooperative groups, thereby laying the foundations for civilization. No civilization is possible without an ethical code that is at least partially valid.

What enhanced civilization was a complex of inventions. Language and large-scale organization were clearly important inventions. The others were new tools for cultivating, processing, and defending food. The early agricultural communities required strong, well-organized defenses since they were highly vulnerable to attacks from marauding bands of hunters and, later, from nomads. Nomadism is an evolutionary step somewhere between a hunting society and an agricultural society in complexity, but it does not have the potential for engendering civilization. The earliest nomads were probably reindeer herders who followed the flocks. Much later they became goat and sheep herders and led the flocks from one pastoral area to another. The nomads represented a type of psychosocial specialization which would lead to evolutionary deadends for whoever adopted this way of life. Only more generalized groups of people than can live by nomadism can create the diversity of skills and the stable resources that can lead to unending evolution.

Another invention which is important for civilization is a device for measuring time. A corollary of the complexity of a culture is its sophistication in its concept of time. The mental model of time varies in our own day as a direct function of the complexity of the culture. Very primitive people live almost entirely in the present. More advanced people have an historical perspective of themselves and plan activities which may be many years in the future. "Advanced" in this context simply refers to a people with relatively higher amounts of true extragenetic information. The earliest evidence of time measuring is in the construction of calendars by the Cro-Magnon tens of thousands of years ago. Many preliterate people had a very deep knowledge of astronomy and calendar making [356, 495]. The most notable of these early machines are the artifacts of Stonehenge, which served rather complex astronomical and date-keeping purposes before the early inhabitants of Britain had a full-fledged civilization, which in fact was introduced by the Romans [208].

A civilized people may be defined as a group of persons tied together by a common ethical code who systematically predict and control their collective ability to predict and control. The essential difference between civilized and uncivilized people is that among the latter there is no systematic group effort by its members to create machines for the benefit of the group as a whole, machines which require several persons to operate and which may not be used for several months or even several years after construction is begun on them. It is this notion of long-range planning and concern for the creativity of future generations which distinguishes the civilized person from the barbarian, who typically never has any vision beyond tomorrow, or the savage, who lives entirely in the present. The longer into the future the planning is projected, the more civilized is the society. Therefore, a civilization never comes into being or survives unless it is guided by a cooperative group of persons who have a vision of and concern for the generations yet unborn. The vision of the future is always tied to the ethical code.

Because the ethical code has traditionally been closely tied to a religion, the major unifying force binding a people together has been religious. As we shall see, in the early civilizations, religion, agriculture, and technology were closely intertwined. In all civilizations, cities, as opposed to villages, begin as religious centers. When the religion and ethical code are out of harmony with the evolutionary ethic, then the civilization will decay and become entropic, in complete analogy with a specializing species. Religion often represents a type of psychosocial specialization which closes the mind both individually and collectively. It is only by radical psychosocial mutation in religion that human evolution continues. Religions do not evolve smoothly, but mutate radically [780]. With the beginning of civilization, human evolution became almost totally psychosocial, and future biological changes were almost entirely entropic. However, the extragenetic

information in the human species began to increase at an exponential rate with the advent of civilized humans.

Until about the time of Darwin humanity clearly had little idea of what it was doing to itself through civilization. Natural selection operated on civilizations just as blindly as it had on the barbarian hunting bands and the savage, individual hominid families before. The extragenetic information increased because those civilizations which did not increase extragenetic information at a high rate, or that went into decline, were destroyed or conquered by barbarian hordes or by more progressive civilizations. We define "progress" as "an increase in the ability to predict and control the total environment" or simply as "an increase in intelligence." We will show that an intelligent civilization without objective ethics becomes unstable and destroys itself or is destroyed by an objectively more ethical civilization. We saw this occur in our own time in Nazi Germany, a highly intelligent civilization which violated the evolutionary ethic and all of the Eight Ethical Principles by persecuting its most creative people; it was, as a consequence, conquered. Therefore, progress is not possible beyond the primitive hominid stage without ethics. In almost all civilizations ethical systems become institutionalized within a religious or quasi-religious framework which becomes increasingly rigid and closed until entropy destroys it. We will now see how this has happened throughout history and develop the pattern by which civilizations have always become entropic.

The Neolithic Prelude

Although religions evolve through radical changes, the evolution of civilization is itself a more gradual process in which technological progress occurs within a relatively fixed ethicoreligious framework. The *Homo sapiens* of 50,000 years ago had a relatively simple technology but probably already had a complex ethicoreligious system which involved elaborate art forms and rituals. Their artistic creations are already evidence that they would engage in complex, drawn-out, group activity for which the rewards were long delayed or perhaps even nonexistent. This mental attitude of intense, long-term activity for a distant reward is what made civilization possible. This began with preparations and magical rites for life after death, but it had an immediate effect in terms of practical technology.

Until about 12,000 years ago there was a gradually increasing investment in time for the purpose of obtaining better tools. This increasing foresight had been going along with increasing brain size for millions of years. As tools increased in complexity, so did the amount of labor necessary to manufacture them. Then about 12,000 years ago there was a radical change in stone technology, which had been basically the same for several million years. Instead of merely chipping and flaking stones to make tools, our ancestors began to grind and polish them to make a wide variety of new

tools. This was the transition from the Paleolithic or Old Stone Age to the Neolithic or New Stone Age [176].

Neolithic technology produced much better tools, but it required a much greater investment of labor plus fixed resources. With Neolithic technology, humanity began to make many new tools which had no other purpose than to make other tools. These included grinding stones, hafted axes with polished blades, needles, clay pots, and relatively permanent dwellings with stone hearths. Fairly large, semipermanent villages of over 100 inhabitants, who lived by hunting, gathering, fishing, and possibly some trading in tools and food, became fairly widespread at this time along rivers, lakes, and ocean shores where there was considerable food. These fairly permanent living areas prepared the way for systematic agriculture.

It is likely that in these villages the men still went on fishing and hunting expeditions while the women cultivated plants and, in essence, invented agriculture. The early Neolithic people and the late Paleolithic hunters greatly honored women and had many female deities. The ancient Chinese symbol for emperor is a female symbol. The role of women began to be degraded much later when standing armies were created [512].

There is clear evidence of agricultural communities with pottery and agricultural tools over 10,000 years ago. These have been discovered in Asia Minor and northern India. There is no clear demarcation between where barbarism ends and civilization begins. These changes in Neolithic living styles from hunters and nomads to permanent agricultural communities clearly represent the transition period. The major mental change which occurred during this period, which lasted about 6,000 years, was an enormous increase in foresight and planning ability on the part of the early agriculturists. The earliest long-range planning went into building religious centers with idols, temples and other constructions for predicting and controlling the behavior of the gods. The oldest known city with permanent dwellings, walls, many religious artifacts, and a population of several thousand was Jericho, constructed about 8,000 years ago [84, 320].

There must have been considerable evolutionary pressure from natural selection to favor those agricultural communities which were most cohesive in organization and farsighted in their planning. These communities would store grain in jars as a hedge against drought and build permanent defenses to ward off the marauding bands of nomads, which were on the increase, and the dwindling bands of hunters. Eventually the purely hunting-and-fishing way of life became obsolete except for the relatively isolated bands of humans in Australia, the Americas, and sub-Saharan Africa. Most of the Eurasian land mass and northern Africa was now dominated by a Neolithic people who were nomads, agriculturists, or a combination of both.

The nomads had the advantage of high mobility and low entropy from human parasitism, but they could not accumulate the machines and

knowledge that were available to the settled agricultural communities in spite of their predilection for engendering human parasitism. Civilizations, up to the present, have had a built-in instability which resulted from increasing collective intelligence while (1) nurturing an ever more parasitical ruling class and (2) forcing their members to become highly specialized. Later we will show how this process is still going on today. In Part II we will show how to overcome it.

Human society for over 10,000 years was in a constant battle involving highly mobile, ethical, generalized, warlike nomads with relatively simple cultures versus sedentary, more peaceful, specialized agriculturists with a more complex culture but increasingly degenerate leadership which corrupted the rest of society. Recall that "culture" is the total sum of extragenetic information a people possesses. The last major nomadic inroads into the civilized world were those begun by Genghis Khan in the 12th century and stopped in the 14th century by agricultural communities in Eurasia.

Therefore, civilization evolved by spurts and stops as the sedentary way of life tested itself against the nomadic way of life. In the long run the civilized mind had to win because it incorporated more coherent information. But as recently as the 14th century, the military superiority of civilization over nomadism was not an obvious fact. The evolution of modern civilization begins at Sumer.

Sumer

It has rightfully been said that history and civilization begin at Sumer [429, 430]. Although we do not know when the transition from barbarism to civilization was made, the Sumerians of 5,500 years ago had clearly already made the transition. In a burst of creativity which was not to be equaled for another 3,000 years, they created cities and vast irrigation systems; invented writing, the plow, the sailing ship, arithmetic, the wheel, institutional government, the first written code of ethics and laws, formal education, and systematic astronomy; baked bricks and cement; and they created the first body of literature, the first written music, and many other firsts which are still embodied in today's cultures. For example, the Sumerians were the first to divide the day into 24 hours of 60 minutes each, a convention that all civilized societies still adhere to. All Old World writing systems, including the Egyptian and the Chinese, were apparently derived from the Sumerians [512]. Indeed all civilization is probably derived from Sumer. The Sumerian musical scale and harmonic forms were the same as were incorporated into all forms of Western music until the 20th century.

The Sumerians apparently invaded southern Mesopotamia (the region corresponding roughly to modern Iraq) about 6,000 years ago, probably by way of the sea. They seem to have come from the region of Iran, although the Sumerian language is neither Indo-European nor

Semitic, and in fact seems unrelated to all other known languages. The true origin of the Sumerian people, therefore, is largely unknown. Northern Mesopotamia had had thriving agricultural communities, if not civilizations, for at least 4,000 years. However, southern Mesopotamia was marshy with irregular rainfall. Therefore, agriculture was feasible only through irrigation. The Sumerians had to conceive, plan, and execute massive public projects for draining swamps, building dams, and diverting the waters of the Euphrates and Tigris rivers along a complex system of canals and irrigation ditches. This required a highly progressive ethical code and system of organization. The early cities were all religious centers run by a priestly aristocracy which appointed kings. As intermediaries for gaining the favor of the gods, the priests were able to control thousands of persons.

Since the Sumerians wrote down their ethical code, we know what it was. They cherished goodness and truth, law and order, justice and freedom, righteousness and straightforwardness, mercy and compassion. They abhorred evil and falsehood, lawlessness and disorder, injustice and oppression, sinfulness and perversity, cruelty and pitilessness. In short, the Sumerians practiced the evolutionary ethic. The Sumerians codified these rather vague but familiar notions of good and evil into a written ethicolegal code. The Sumerians followed most of the Ethical Principles, except they were unethically gullible in their religious beliefs, and they used means which were not ends as well as unethical means. The Sumerians eventually degraded women. For example, only women were allowed to be enslaved. This contributed to their ultimate downfall by violating the third Ethical Principle. Eventually they would be destroyed by their unethical religious and cultural traditions, as would other civilizations which incorporated them.

The Sumerians had a polytheistic religion with hundreds of invisible gods and a view of life that man (women were not important) was created *solely* for the benefit of the gods. Man was seen as a complete puppet devoid of free will and in the hands of the gods, who made him behave for their own purposes. To disobey the will of the gods as interpreted by the priests would bring disaster to any individual. This was clearly an effective, although unethical, psychosocial tool for controlling human behavior. Ethical behavior induced by fear is ultimately destructive. Both the good and the evil of the world were created by the gods, but the gods themselves were entirely "good." This somewhat paradoxical position was apparently never resolved by the Sumerians, but it produced a sense of fatalism which eventually undid them.

As the Sumerian civilization became increasingly complex, there developed a true middle class of scribes, governors, ambassadors, temple administrators, sea captains, tax officials, priests, architects, accountants, and military leaders, the king being the commander-in-chief. As organized warfare between Sumerian and other non-Sumerian cities developed, the

importance of the king increased and the kingship became hereditary. The Sumerian school system, which was to serve as the archetype for middle-class education through to the present, served almost entirely the interests of this class. There is considerable evidence that women, the children of the poor, and slaves had no opportunity at all to educate themselves. This violated the evolutionary ethic by restricting the flow of information and produced an increasingly specialized society in which knowledge was constantly narrowed until the collective mind of the Sumerians was closed. The process was abetted by a fossilized, fatalistic religion and another Sumerian innovation: bureaucracy.

A bureaucracy is an organization with a built-in mechanism for destroying negative feedback. An organization, we recall, is a group of persons with common goals and rules of behavior. All bureaucracies are organizations even if they are organizations of two persons. Not all organizations are bureaucracies.

The Sumerian bureaucracy was primarily a civil service directly responsible to the hereditary king of each of the rival city-states. The civil service was inextricably intertwined with the religious bureaucracy which administered the temples, both bureaucracies being products of a common educational system. Together the secular and religious bureaucracies became organizations with no other purpose than the protection and extension of their privileges. They jointly controlled all food production and the educational system. The bureaucracies served as an entropic sink—a psychosocial black hole—which destroyed ethics, absorbed the intellectual energies of the people, and created nothing. The dynamic, creative traditions of over a thousand years eventually succumbed to useless religion and parasitical bureaucracy, which fostered specialization and destroyed imagination. The Sumerians were conquered about 2300 B.C. by a more primitive but less entropic people, the Akkadians.

Akkad—The First Empire

Sumer consisted of a loose confederacy of several rival city-states, each ruled by a hereditary king. At first a single king in the chief temple city was the king of all Sumer. Then the kingship would go from city to city, depending on which city was in ascendancy. Eventually each city had its own king. However, there was never a single unifying ethic which would unite all of Sumer. The semicivilized people to the north were for centuries little or no threat to the highly advanced Sumerians. One Sumerian king was eventually able to completely dominate two cities, but by this time the Akkadians immediately to the north were able to absorb enough true information from Sumer without being burdened by the same extensive bureaucracy and false religious information.

Technology, particularly simple technology, is much more easily

transferred than ethical or religious information. This is the case because technology usually brings immediate benefits without hurting the ruling class. New ethical or religious ideas often disrupt the religious bureaucracy, which is typically integrated with the ruling class. Since religious ideas are rarely objectively valid, there is no logical reason for accepting one religion over another unless that religion is either (1) more emotionally satisfying or (2) imposed by force. Therefore, the Akkadians, who were a Semitic people in close contact with the Sumerians, were able over the centuries to absorb much of the true information of Sumer without absorbing too much of their entropy—particularly that entropy associated with bureaucracy. Furthermore, Akkad, about 4,200 years ago, was a relatively new society led by the highly progressive, indeed, visionary king, Sargon I.

Sumer, because of the centuries of hereditary rule, was almost certainly led by mediocre kings. Because of genetic regression, hereditary rule almost always leads to mediocre leadership in a few generations and may occasionally produce disastrously bad leadership despite the brilliance of the original king [208, 512]. The leading city of Akkad, Kish, had been continually trounced in war throughout the centuries by the more civilized Sumerians. Each time Akkad was defeated it used this negative feedback to learn from the Sumerians and to make way for a new, more competent king. Eventually Akkad had all the technological knowledge of Sumer *plus* a much more progressive king. At this time Sumer was conquered and the Akkadian Empire was formed. It was the Romans who later learned that a vigorous alien culture which is merely defeated will arise again with renewed vigor. Therefore, the Romans eventually totally annihilated Carthage.

Sargon I was not content to conquer Sumer, but extended his rule and civilizing influence to all of Mesopotamia and through his successors eventually as far as Syria, Arabia, Persia, Palestine, and possibly Crete. Sargon I was a creative leader who civilized the primitive people he conquered and preserved what was best in the Sumerian civilization. He and his sons played a role in Sumer similar to that which Philip and Alexander were to play in Greece two thousand years later. The Akkadians had so much respect for the Sumerian civilization that they and their successors continued to use Sumerian for literary, technical, and religious writings for centuries after their conquest, very much in the way Latin was used in medieval Europe. Unfortunately this intimacy with the Sumerian culture eventually spread the Sumerian religious beliefs also. And the Sumerians eventually gave not only the progressive aspects of their civilization to Mesopotamia for thousands of years to come, but also their rather destructive religion which, when combined with Semitic idol worship and hedonism, was to lead to a highly unethical, destructive, religious bureaucracy.

The religion of Sumer remained essentially the same throughout all of Mesopotamia for over 4,000 years—long after the Sumerians and their spo-

ken language had disappeared. We note that many Sumerian myths, including the "Adam and Eve" and "Noah" myths, were incorporated by the Hebrews two thousand years later when they were in Babylonian captivity. The Sumerian-based religion, besides involving persons in wasteful sacrifices, massive temple building, and complex rituals necessary for obtaining the favor of hundreds of specialized gods, consumed the intellectual energies of the best minds of the civilization. Thousands of books (that is to say, archives of clay tablets) were written on how to interpret sheep entrails for predicting the future. Many more books were written and thousands of person-years were expended developing the delusions of astrology, fortune-telling, divination, and witchcraft that appeared at this time and still persist today as an entropic inheritance from the Mesopotamian civilization. The net effect of this was a growing entropy in Mesopotamia that destroyed its creativity in spite of periodic expansions through military force. From at least two centuries before the fall of Sumer in 2,300 B.C. there was no single important invention created in Mesopotamia, although technological improvements were repeatedly made—particularly in political organization. The major technological innovations of the next two thousand years were (1) the smelting of iron, (2) the domestication of the horse, (3) the invention of the spoked wheel and the war chariot, (4) the development of the alphabet, and (5) the creation of mathematical geometry. All of these inventions were to be developed by persons on the fringes of the Mesopotamian empire.

Just as the Akkadians had absorbed what was best in the Sumer but limited at first their absorption of what was worst—namely the religion, not the ethical code—so did the less civilized people on the fringes of Mesopotamian civilization absorb what was best; but to a great extent they rejected the religión and bureaucracy of Sumer. The major Mesopotamian technological development was in learning how to administer an ever larger and more complex empire. The Mesopotamian empire reached its maximum expansion under Assyria in the seventh century B.C. Mesopotamia itself was to be in constant turmoil for the rest of its history, with less civilized but also less entropic groups constantly invading, destroying, and replacing the current Mesopotamian imperial dynasties.

The Akkadian empire lasted less than 200 years before it fell to Semitic, nomadic invaders, partially as a consequence of too rapid an expansion beyond its technical capacity to administer, but mostly due to the entropy of bureaucracy and hereditary rulers. The collapse of Akkad plus the negative feedback of having been conquered by a less civilized people gave one Sumerian city, Ur, the vitality to begin a new, vigorous Sumerian empire called Ur III. (For the third time the Sumerian kingship was in Ur.) It wasted considerable energy in temple building and lasted about 100 years. The Sumerians and the Akkadians, like all future imperial people, never learned that without continuous ordered expansion there is no secu-

rity for any empire. After the collapse of Ur III the Sumerian people and spoken language quickly declined and disappeared.

Next a new empire was formed north of Akkad with its center at Babylon. This and all future Mesopotamian empires were known as Babylonia, even when their capitals were in other cities. But before the formation of the first Babylonian empire, the collapsed civilization of Ur III produced a man who through his descendants was to alter the course of world history. He was Abraham, the patriarch of the Hebrews and Arabs.

Babylonia

The Babylonians were another Semitic people, closely related historically and linguistically to the Akkadians. They adapted the now familiar Sumerian-Akkadian cuneiform to their language and set about conquering Mesopotamia under the brilliant founder of the Babylonian Empire, Hamurabi, in the eighteenth century B.C. By this time the old Sumerian religion was an integral part of the culture of all the civilized people of Mesopotamia. They merely modified it by making the local chief deity (this was Marduk in Babylon) the king of all the gods in the Sumerian pantheon, but otherwise adopted all the entropic religious customs of the Sumerians. Although Hamurabi was a farsighted leader and brilliant administrator, none of his sons matched his brilliance, as would be predicted most likely from genetic theory [245, 389, 744]. The Babylonian empire collapsed shortly after Hamurabi's death and underwent a series of convulsions for the next 600 years until the rise of the Assyrians, who now played the role of the semicivilized neighbors of the Babylonian empire. But for the next 2,000 years Babylon was to remain the cultural center of Babylonia even when the Assyrians built their capital in Nineveh.

The Assyrians and the Aryans

The Assyrians, another Semitic people closely related to the Akkadians and Babylonians, were quick to assimilate the culture of Babylon (they had written in Akkadian since the nineteenth century B.C.) and may have succeeded to Hamurabi's empire since Shamshi-Abad I was the Assyrian leader at the time of Hamurabi and seems to have been his intellectual and ethical equal [512]. However, at about the time that Hamurabi died, Mesopotamia was invaded by Aryan-speaking, nomadic barbarians who had invented a radical, new military technology—the war chariot. The Aryan languages are also known as "Indo-European."

At this time only the Aryans of the steppes of western Asia had extensively domesticated the horse and combined this biological machine with a light, spoke-wheeled chariot which represented a significant improvement over the original solid-wheeled ox-carts of the Sumerians. With this inven-

tion, they were able to decimate the Mesopotamian armies of foot soldiers. Indeed, the barbarian Aryan invaders spread as predators over the next 500 years throughout the civilized world.

These were the ancient Mycenaeans and later Dorian Hellenes who were to create classical Greece. These were the Aryans who were to create the classical Indian and Persian civilizations. These were the Hyksos (partially semitized) who conquered Egypt. These were the Tocharians who may have penetrated into China, introduced the Bronze Age and chariots, and founded the Shang dynasty, the first true Chinese empire. The preceding Hsia dynasty, apparently a matriarchy, only ruled over large neolithic villages. These were the Hittites who first smelted iron and formed the first purely Aryan civilization.

Whenever the Aryans met a well-established, advanced civilization, they became a ruling elite constituting a small minority of the population and were eventually totally absorbed by the civilization. This happened in Mesopotamia, Egypt, and China. In India, the Aryans formed the caste system in order to maintain their identity; but even here, after destroying the civilization of the culturally advanced, dark-skinned Dravidian people of the Indus Valley whom they apparently found repellent [609], they were genetically, if not linguistically, absorbed by the more civilized Dravidians who migrated to southern India after the destruction of their civilization (note that the Sanskrit word for caste is "varna," meaning "color"). In Europe, which was almost entirely barbarian except for the Minoan periphery of Greece, the Aryans represented the most civilized invaders who imposed their language and culture on the indigenous people.

We note that recent archaeological evidence indicates that the Minoans were a Semitic-speaking people. The Aryan invaders were the inheritors of the megalithic structures of Malta and Stonehenge. Some of the early Aryan religious customs survived among the Celtic druids. The only European groups to escape Aryanization at the time were the Basques. Recall that these may be direct descendants of the Cro-Magnon. Finns, Estonians, and Magyars, who are all linguistically related in the Fino-Ugric language group, are nonAryans who came to Europe later.

The Aryans conquered and were completely absorbed into the sumptuous civilization of Babylon under the Kassite dynasty; but the more primitive and vigorous Assyrians were never completely conquered, and they in turn absorbed the Aryan technology and in time surpassed it. The Assyrians became as proficient as the Aryans in breeding and domesticating horses and created the first war tactics using massed chariots. However, they were eventually to be undone in the seventh century B.C. by a new Aryan invention, light cavalry. In the meantime, the Assyrians learned about the smelting of iron from the Hittites, who were the most civilized Aryan group of the time. In 1370 B.C. the Assyrians began through fits and starts to create what by the seventh century B.C. would be the greatest

empire the world had ever seen. They were aided in this by the successive waves of Aryan barbarians who continued to disrupt, albeit ever less effectively, the civilization of their more cultured cousins. The Hittites, who militarily defeated Ramses II in the twelfth century B.C. and formed alliances with Assyria, also served this purpose.

The Aryan barbarians would arrive full of primitive ethical vitality and overwhelming military superiority in the first wave. They were doing their best to extend their mastery over the total environment. They would then form a ruling elite and become civilized, parasitical, and corrupt, at which time they would be conquered by another Aryan wave which was now not so technically superior, although it might have more ethical vitality. Nothing corrupts a human being as much as having power by force over other human beings. Eventually, in each civilization, the Aryan invaders were repelled because they no longer had clear military superiority. In the sixteenth century B.C. the Egyptians revolted against and expelled the Hyksos, who were not really Aryans any more; they had became totally semitized and Egyptianized, but they were racially different and they were hated by the Egyptians. The Assyrians rose up against the Aryan invaders who were threatening to enslave them in the fourteenth century B.C., and thus they began to take the first steps toward the formation of the Assyrian Empire.

The Assyrians saw themselves as the ethnic, spiritual, and intellectual inheritors of the Babylonian Empire. They were pressed against the wall by the Aryan invaders and responded by defeating them and then extending their domain during the next six centuries until they had conquered all of the Middle East, Egypt, and even parts of Nubia and Ethiopia, from whom they collected tribute. However, the Assyrians were Babylonized and did not have the qualities of mind and ethics which produce inventiveness. Therefore, the Assyrian Empire was disrupted from the steppes by a new horde of Aryan invaders, the Scythians, who had two new inventions—saddles and mounted cavalry. It would be over 1,500 years before a Semitic people (the Arabs) would again be able to form an empire in opposition to the Aryan hegemony, and it would be a psychosocial innovation (Islam) which made it possible.

The smelting of iron was a critical invention developed sometime about the fourteenth century B.C. either among the Hittites or their more barbarous Aryan cousins. Iron was far more abundant than the constituents of bronze, which was the basis for the weaponry of the charioteers. Chariot weaponry was very expensive and limited to a small elite, which in turn made it possible for small numbers of barbarian nomads who had the chariots to "domesticate" civilized masses of human beings who did not have them. Civilized people represent a human analog of domesticated animals; wild animals are difficult to tame as are wild nomads and hunters. Therefore, the peculiar Aryan mental characteristics—they saw

themselves as a "master race" destined to rule over the contemptible, inferior, civilized peasants and degenerate, soft imperial and priestly bureaucracies—lent themselves to the "new order." But the Aryans would quickly acquire the weaknesses of their civilized subjects and in the process often lose their major virtues of technical inventiveness and ethical vitality, albeit of a primitive kind.

The invention of iron smelting made it possible to democratize warfare so that every able-bodied man could wield a weapon and participate. This greatly increased the collective intelligence of the group by diffusing military knowledge and capabilities among the entire group. The first people to exploit this capability were the Hittites, who were able to defeat the armies of Ramses II in the 12th century B.C. because they had iron weapons while the Egyptians had ceased to innovate technologically. The Hittites tried to keep the smelting of iron a secret, but even though it was a complex process requiring systematic forging, quenching, and eventually alloying, the process was able to spread. By 800 B.C. it was known all over the civilized world and even in parts of sub-Saharan Africa. The Assyrians used iron weapons to consolidate and spread their empire. However, mounted cavalry was an entirely new concept which caught the Assyrians unprepared.

The horse had been domesticated for over a thousand years. Horseback riding was known as early as 1900 B.C., but it had little military value because it was very easy to unseat a horseman. The invention of the saddle and the technique of shooting a short but powerful double-bent, compound bow from horseback while riding at full gallop gave tremendous military advantage to the highly maneuverable Scythian horsemen over the less maneuverable charioteers. The charioteers required two skilled men per chariot and a considerable capital investment. The Aryan steppe nomads lived in the midst of the largest horse herds in the world and could smelt the abundant iron ore. They combined these technologies to produce the first mounted cavalry around 900 B.C.

The nomads would sweep down from the steppes in groups of several thousand and plunder the civilized communities of the Middle East. (The Scythians were the source of the Centaur myths.) In the process they destroyed the Assyrian Empire. However, unlike the earlier Aryan invaders, the Scythians were totally contemptuous of their conquered subjects and refused to become civilized. Therefore, they violated the evolutionary ethic by not maximizing ethical intelligence, and they in turn were eventually to be destroyed by more civilized peoples who had mastered cavalry technology. The last Scythians were annihilated by the second century B.C. But before this happened a series of radical psychosocial mutations occurred throughout the civilized world that were forever to alter the mind of man.

An Ethical Singularity

In the sixth century B.C., all the civilized regions of the world within about 50 years of each other underwent an ethical revolution. In many different ways they invented a new dimensional quadrature of mind: morality—the ability to predict and control their own ethics. In China, Confucius, an impoverished nobleman, articulated the ethic that knowledge was the greatest good and that only the most knowledgeable and ethical men should be allowed to govern other men. Among all knowledge, the most important was how persons may live in harmony with one another and with nature. Confucius incorporated this ethic into five books which served as a guide to personal conduct and government in China for 2,500 years and became the basis of Chinese civilization for the last 2,000 years.

In India, Siddhartha, a Hindu prince, later Gautama Buddha, articulated the ethic that the source of all knowledge came from within the self and that through self-discipline, meditation, and ethical behavior a person could become one with the universe and lose oneself within the cosmic force, thereby avoiding the endless cycle of death and rebirth, which the Hinduized Aryans of India believed to be the common lot of humanity. The ultimate goal of life was truth and truth came from within one's self. Ultimate reality was subjective and mystical, not objective and scientific. This ethic, in various forms, became the basis of the civilizations of India, Tibet, and southeast Asia and persists to the present time. In much more limited forms, it was incorporated into Japan under Zen Buddhism in the ninth century A.D., where it was hybridized with Shintoism and the Japanese code of Bushido.

In Persia (Iran) an Aryan prophet, Zoroaster Spitama, proclaimed the religion of Zoroastrianism, which saw the world divided in an eternal conflict between two cosmic forces—life, light, truth, order, and goodness (evolution) on one side, and death, darkness, falsehood, disorder, and evil (entropy) on the other side. The personification of goodness and all creation was Ahura Mazda (God and the only object worthy of veneration). The personification of evil and all destruction was in Ahriman (the devil and constant enemy of all good men). The greatest evil that a human being could do was to lie and destroy; he thereby aided Ahriman and the forces of evil. The greatest good that a human being could do was to spread truth and create; he thereby aided Ahura Mazda in his battle against Ahriman. When a person died, his acts were judged by Ahura Mazda and according to the value of his life he either became part of the kingdom of light and truth or was condemned to eternal horror and darkness. There were simple rituals associated with Zoroastrianism involving purification and holy fire and certain taboos such as not burning or burying corpses or in other ways polluting the sacred earth or defiling the holy fire, which as a source of

light was an emanation of Ahura Mazda. But the basis of Zoroastrianism lay in personal ethical action and the search for truth. Zoroastrianism formed the ethical and religious basis for the Persian empire and remained the official religion of Iran until it was forcibly supplanted by Islam 1,200 years later. It still survives today in Iran (with difficulty) and among the Parsis of Bombay, who are among the most creative and progressive people in India.

In Babylon, the enslaved Hebrew exiles, who had been captured and deported from Judea (589 B.C.) by Nebuchadnezzar fifty years after the fall of Assyria and the formation of the second Babylonian empire, took their primitive tribal worship of the immaterial war God, Yahweh, and the corresponding rituals and combined them with Babylonian myths and ethics to create the first truly monotheistic religion. Recall that the Garden of Eden fable and the story of Noah are traceable to the Sumerians, who also worshiped invisible gods. This is opposed to the monolatry of Atonism in Egypt and the essential dualism of Zoroastrianism. The myths surrounding Sargon I were similar to those of Moses. The later Jews saw God as a universal, abstract force that could not be represented by visual imagery but which was the single cause behind all events—good and evil. The purpose of man was not to try to seek favor with God, but to obey his laws as ends in themselves. Buddhism, Judaism, and to a lesser extent Zoroastrianism were the first religions which saw ethical behavior as an end in itself and not as a means for obtaining divine rewards. It is likely that Zoroastrianism and Judaism influenced each other in Babylonia when the Persians freed the Jews from slavery. The Babylonian enslavement convinced many Jews that ritualistic behavior and obedience to religious law alone would not ensure them any benefit. Therefore, these enslaved Jews—who looked upon the idolatrous Babylonians, with their institutionalized temple prostitution, animal and occasionally human sacrifices and fertility rituals, as their spiritual inferiors but obvious military and intellectual superiors—began to recast their self-image as a spiritual people chosen by God not for worldly favor but to set an example of moral rectitude for the rest of mankind by living in strict accordances with God's commandments. The Ten Commandments themselves, as well as many other Jewish ethical imperatives, are directly derivable from the evolutionary ethic and/or the Eight Ethical Principles.

The ethical stoicism and abstract nature of Judaism were to serve as a psychosocial catalyst in human history, completely analogous to the role of enzymes in living creatures. From this time on the Jews would catalyze and accelerate the rate of human evolution. Almost every important psychosocial mutation (for better or worse) of the last 2,500 years has intimately involved the Jews. This includes the synthesis of Christianity, Islam, scientific ethics (Spinoza), modern science (Einstein), psychology (Freud), and communism (Marx and Engels). No other religious group has ever been

able to maintain its identity under such adverse circumstances for so long. The special role of Judaism in psychosocial evolution is discussed later. Judaism was to become a synergetic catalyst to the separate but equally important ethical and psychosocial mutation which was occurring in Greece at the same time.

The barbaric Aryans, in successive waves starting in the seventeenth century B.C., conquered Greece and the surrounding Minoan civilization, which was of Semitic origin and just as complex as those in Mesopotamia and Egypt. The Greeks were able to form a civilization which was to become the top rung of the ladder of psychosocial evolution. What gave this culture its unique characteristic was the influence of Thales in the sixth century B.C.

Thales was a widely traveled Greek merchant, possibly of Semitic ancestry, who was familiar with all the cultures of the Middle East and of Egypt. He postulated that humanity could learn about all aspects of nature, including itself, by rational inquiry and needed no divine revelation or guidance. Truth was the highest goal, and rational inquiry was the way to reach it. Toward this end Thales began to axiomatize the empirical geometry of the Egyptians and Babylonians and created theoretical mathematics, one of the cornerstones of systematic science. At the same time he and a small circle of friends (the pre-Socratics) began to explore the physical, biological, and psychosocial worlds, asking why things are as they are. Their answers were in remarkable agreement with modern science. Thales assumed that the universe was governed not by the capricious whims of anthropomorphic Gods but by rational laws, just as the egalitarian, democratic societies of the sixth century B.C. Greek city-states were governed by rational laws, not by the capricious whims of kings and tyrants.

This new, atheistic, rationalistic view of the world was as radical and far reaching in its psychosocial consequences as was the creation of language by early *Homo sapiens* or the creation of civilization by the Sumerians. This view, which is the essence of Greek philosophy, initiated a period of intense creativity in Greece which led in only 300 years to the creation of the foundations of Western civilization. Socrates turned rational inquiry onto ethics and explored for the first time the ethical nature of humanity in a rational way. This is morality, the ability to predict and control our own ethics.

Greek philosophy faltered during the Roman period and the semibarbaric Middle Ages, but it was revived with renewed vigor during the Renaissance 2,000 years later. It has led to the modern world. In time, Western civilization became so superior that all other civilizations had to copy it or be overwhelmed. Modern science, which is a direct consequence of Greek philosophy, in the last 300 years has increased collective human intelligence more than all the previous civilizations of history combined. However, modern science has one additional element which was missing from Greek

philosophy—the notion of objective, experimental verification for all models of nature. More will be said of this later. For now we merely note that traditional Greek philosophy, when joined with the ethical direction of Judaism and its psychosocial mutations, is the psychosocial basis of current human evolution.

Some final observations about the world ethical singularity which occurred in the sixth century B.C. must include the following. While the ethical revolution was beginning in Eurasia, the first true civilizations, Maya in Mexico and Nazca in Peru, were beginning independently and coming to fruition in the Americas in very much the same way that Sumer developed. Taoism, the ethically mystical but highly creative, complementary rival of Confucianism, also began at this time in China under the influence of Lao-Tse, a contemporary of Confucius. In Greece, and later southern Italy, Pythagoras began the Western mystical tradition and created a mathematical religion in creative harmony with and complementary to Greek philosophy. Taoism and Pythagorism show how ethics, mysticism, and reason can interact synergistically to maximize creativity.

Ethical Comparisons

An extraterrestrial observer looking at all the developments of the sixth century B.C. might have been hard put to predict which of the ethical systems would lead to the most progressive civilization. Each had inherent weaknesses, and indeed it was not any one whose progeny made it to the top of the evolutionary ladder but rather a complex hybrid which occurred between Greek civilization, Judaism, and, to a much lesser extent, Zoroastrianism. From an evolutionary, ethical perspective we can immediately see what these major weaknesses were.

Confucianism violated the sixth Ethical Principle. Independently of whatever Confucius may have actually said, Confucianism eventually developed the certainty that all important truth was contained in Confucius' five books and the corresponding "Classics." The greatest wisdom according to Confucius had been a product of China's past. The Chinese became disdainful of any outside cultural developments and gave overwhelming importance to a self-perpetuating bureaucracy of smug, self-satisfied Confucist scholars, which ceased to be creative. They did not doubt their own knowledge (sixth Ethical Principle). Still, Confucianism was clearly in at least partial agreement with the evolutionary ethic and put a high value on truth—even if it had a very limited view of what truth was. During the T'ang dynasty of 1,200 years ago, the Chinese may have been the most culturally advanced, civilized people on earth, and they were clearly highly creative. Chinese creativity owed much to the Taoist traditions. Among the Chinese inventions by the time of the T'ang dynasty or soon afterwards were the compass, gun powder, printing, papermaking,

and other practical technologies. Yet they lacked the special, vital spark which had characterized classical Greece and was to be even more marked in the Renaissance and its consequent era. Confucianism eventually ended in a sterile bureaucracy, unable to resist Western culture until it was overwhelmed by a new Western ethical system and religion, communism. Confucianism still has much to offer in terms of personal ethics and as a guide to social conduct. It is hybridizable and compatible with objective evolutionary ethics. It is ethically superior to Marxism.

Buddhism valued truth and had an ethical code in harmony with the evolutionary ethic, Buddha's eightfold path. It is admirable in being the only major religion that did not systematically persecute people because of their religious beliefs. However, Buddhism was an evolutionary deadend because it induced its practitioners to disregard the objective world. It represented an extreme form of psychosocial specialization which closed the human mind to objective reality. This diminished creativity for all who would fall into the entropic trap of self-delusion through specialization in subjective truth. The basic goal of Buddhism was to eliminate suffering through eternal death by eliminating all desire and the abolition of the ego. Since the desire for creativity must be maximized, not minimized, this was in violation of the evolutionary ethic. Buddhism decreased creativity through psychosocial specialization and by valuing the absence of suffering more than the presence of creativity, thereby violating the second and fourth Ethical Principles respectively. Buddhism induced a passive, contemplative life of inaction, thereby increasing the entropy of society through violation of the eighth Ethical Principle. The fourth Ethical Principle is further violated by a plethora of useless rituals such as prayer-wheel spinning, monastic begging, and other prayer rituals. There has never been a Buddhist civilization that was technologically innovative, with the partial exception of the Asoka kingship in India, which ruled the Hindu majority who were more dynamic and creative.

India was able to temporarily avoid the irreversible entropy of Buddhism by hybridizing it with the older, more primitive but more action-oriented Aryan traditions. (We note that Buddha was an Aryan; his philosophy is sometimes called the "Aryan Way.") The Hindu scriptures are constantly extolling ethical action as an end in itself. "There are no means but only ends," says Lord Krishna to Arjuna [859]. Karma Yoga is the pursuit of ethical action without fear of punishment or expectation of reward. But still the Buddhist attitude became entrenched in India, and it spread, even if it was not called Buddhism. Today we can see thousands of Indian mystics living lives of inaction and contemplation, impervious to their own decay and that of their society. But prior to this, India was a highly creative society, particularly in the field of mathematics. India still produces through Western cultures some exceptionally brilliant mathematicians and theorists, e.g., Ramanujan, Raman, Bose, and C.R. Rao.

In Japan, Buddhism took a peculiar twist in Zen Buddhism, which came by way of China, like almost everything else in traditional Japanese culture. Zen Buddhism was action-oriented. In Japan the Zen view became that one reached enlightenment through personal perfection. This produced a disciplined mentality which sought to become highly proficient in a narrow specialty. It was particularly well suited to the military code of Bushido. It produced superb warriors, artists, artisans, and businessmen, but it destroyed the imagination by narrowing the mind to concentrate on one small aspect of the total environment and in the end decreased creativity by producing a society that could perfect any technology but could invent nothing of its own. In today's Japan, if we take away from the culture what was created by China and then what was created by Western civilization, we are left with virtually zero. Still the Japanese are a dynamic and vigorous people who may reverse their way by refusing to allow their society and the world to cast them into a specialized mold. The Japanese are highly creative outside of Japanese culture. Buddhism is not central to Japanese civilization, and as such it has not led to irreversible entropy there, as it did in Tibet and southeast Asia. Still the worst persecutions in the name of Buddhism were committed by the Tokugawa Shogunate in the 17th century against Japanese Christians in order to consolidate its political hegemony.

Zoroastrianism, on the surface, seems like the system most compatible ethicoreligiously with objective evolutionary ethics—particularly if we interpret Ahura Mazda and Ahriman symbolically as figurative representations of the basic cosmic processes of evolution and entropy respectively. We also note that the prime ethic of Zoroastrianism, the maximization of truth, is in close correspondence with the evolutionary ethic. However, Zoroastrianism developed a weakness which may or may not have been inherent in Zoroaster's design. Zoroastrianism was ethnocentric. It was created by and for Persians and admitted no converts, at least not officially. This made the system closed to the rest of humanity. As in the case of all closed systems, it developed irreversible entropy by violating the first and fourth Ethical Principles. One cannot maximize ethical intelligence in a civilization if one systematically excludes all ethical persons who wish to join it but who were not born into it. This is a means which is not an end. The fourth Ethical Principle is also violated by the compulsive, ritualistic behavior which became entrenched in the Zoroastrian religion. Humanity has a tendency to become addicted to useless ritual which is substituted for ethical action. A modern version is television viewing.

Still the Persian civilization was highly ethical and progressive for 1,200 years (e.g., they invented the windmill). Once Zoroastrianism became the chief religion, the Persians drove back the Scythians and took over what had been the Assyrian Empire and then expanded it. Eventually they were to invent the technology of heavy cavalry, which was copied by

the armored knights of Europe. They were tolerant of other religions and built a civilization which survived the Greek conquest of the late fourth century B.C. Persia remained Persia and progressed until the seventh century A.D., when Islam began the systematic destruction of the highly bureaucratized Zoroastrian civilization. Islam was a less creative but more genetically open civilization than Zoroastrian Persia. However, Islam was totally closed religiously to new ethical ideas.

Today Parsis are among the most artistically creative and progressive people in India, being among the best educated and most industrious. But they are an inbred, genetically degenerate minority full of congenital defects and diseases. The Parsis are becoming extinct because their death rate is higher than their birth rate and they accept no converts with which to hybridize and improve their genetic stock.

Judaism eventually emphasized ethical behavior as an end in itself, not as a way of avoiding punishment or receiving rewards. It emphasized mutual ethical obligations. However, Judaism violated the fourth Ethical Principle by its compulsive, ritualistic behavior, which sapped the creative energies of its people. The Jews also violated the second Ethical Principle by becoming intellectually specialized (recall that specialization is always destructive) in analyzing their own religion to the exclusion of other fields of knowledge. Therefore, a disproportionate number of highly intelligent Jews have historically remained ignorant of all intellectual developments outside of their religion. The Jews were unable to resist successfully the Roman conquests and the dismemberment of their nation 600 years after the Persians had freed them from Babylonian captivity. We note that the Romans were never able to conquer Persia. It was only when Judaism became hybridized with a culture which incorporated Greek philosophy in some form, and at the same time gave Jews an opportunity to participate in this culture, that Jews relaxed their ritualistic compulsiveness and began to acquire knowledge outside of their religion.

In this way, the Jews catalyzed other civilizations, but they could not catalyze themselves. The Roman destruction of the Jewish nation made inevitable the hybridization of Greek philosophy with Jewish ethics through Christianity. When this happened, the Jews would catalyze their host culture and make it evolve or decay more rapidly. This happened in parts of the Roman Empire, particularly Alexandria. This happened in Islam. Then it happened predominantly in the Protestant countries of Europe, but also in the Catholic countries. It happened in 15th century Spain and 20th century Germany. It is happening today in the United States and the Soviet Union. About half of the Nobel Prize winners in science and economics have been Jewish, although the Jews are less than 0.025% of the world's population. The Jews are about 35% of the persons listed in Who's Who in the United States, although they are less than 3% of the U.S. population. They have played a similar role in the Soviet Union. Relative to their num-

bers the Jews are by far the most creative persons on earth. They catalyze other nations through their creativity.

The creativity of the Jews is due to ethics and natural selection. Once the Jews became a persecuted minority in Christendom, there was an enormous economic and social advantage to being converted to the local sect of Christianity. The only reason for resisting was because of the higher ethical standards of Judaism, which was not guided by extrinsic rewards and punishments. At the same time Jews had to be highly intelligent to survive the persecution by their Christian neighbors. Therefore, only persons who were both highly ethical and intelligent, i.e., highly creative, could survive as Jews. Otherwise, Christians remained Christians; unethical Jews converted to Christianity; and the less intelligent Jews died. Therefore, through ethical choice and natural selection the Jews became highly creative.

Greek philosophy had everything except the ethical direction which so characterized the Jews. The Greeks valued truth as a means to achieve individual superiority. They had little love or compassion for others. They were indeed arrogant and overbearing toward each other. They lived parasitically within a slave-based society, eighty percent of which consisted of ruthlessly exploited slaves, thereby violating the third Ethical Principle. Without a unifying ethical code in harmony with the evolutionary ethic that stressed mutual ethical obligations, the Greek city-states broke down into squabbles among themselves. The Greeks were unable to become freely united into a single civilization because they lacked love for one another and lacked love even more for nonGreeks, all of whom they considered inferior barbarians, virtual subhumans. Eventually a semibarbaric people on the fringe of the Hellenic world—the Macedonians—played the now familiar historic role of conquering their teachers and ethnic cousins, thereby uniting them by force. But it is unethical to force people to participate in a unified culture and unethical means cannot achieve ethical ends (third Ethical Principle). Therefore, the Greek empire, the greatest in history to that time, disintegrated in the same generation that it was created by Philip of Macedon and his son Alexander.

From this time forward, the influence of Greek philosophy was to steadily decline, until it was revitalized by the Renaissance 1,800 years later. Nevertheless, the Greeks produced the most creative civilization of the ancient world. Part of this spirit is captured in Greek art, drama, and architecture, but most of all in the philosophy of the pre-Socratics (sixth and fifth centuries B.C.), the teachings of Socrates, Plato, and Aristotle (fourth century B.C.), the mathematics of Pythagoras, Euclid, and Archimedes (third century B.C.), and the school of Alexandria, which continued to increase human creativity well into the Christian era.

The Prelude to Christianity

Christianity represented the first hybrid offspring of Greek philosophy and Judaism. Unfortunately it also incorporated some of the worst elements of both, the intolerance of Judaism plus the abstract mysticism and pathological antisexuality of Plato. Therefore, Christianity had mixed results. But in order to see Christianity in a proper perspective we will first consider the evolutionary environment into which Christianity was born.

Egypt

The religious degeneracy of Mesopotamia has already been discussed. However, this was not the only great civilization of the area which had been destroyed by religious bureaucracy. Classical Egypt began, at least in part, as a cultural offspring of Sumer at the end of the fourth millennium B.C. (the unification of the upper and lower Egypt in the old kingdom under Menes). Egypt and Sumer had been active trading partners for centuries. But, as is often the case, Egypt took mainly the material culture of Sumer and not its ethicoreligious system. The Egyptians lived in the best possible geographical location for civilization to develop. The extremely fertile Nile valley was 600 miles long, protected from invaders by sea, deserts, and mountains, and it was provided with a natural transportation system in which ships could effortlessly coast down the Nile from upper Egypt to lower Egypt and sail up the Nile almost as effortlessly from the constant winds blowing toward the south.

Transportation along the Nile was the key to the control of Egypt. This made it easy for a single administrative center to control the country and all its cities (a goal never achieved by the Sumerians) through a few garrisons strategically placed along the Nile. However, the religion made it even easier to control the people.

The overwhelming goal of Egyptian society, apparently from early neolithic times, was immortality. The Pharaoh was a God-King who was himself immortal after death and could grant immortality after death at will to any of his subjects. By dangling the reward of immortality before his subjects the Pharaoh could make them do almost anything he wanted, including building some of the most massive structures ever conceived—structures which must have taken tens of thousands of laborers many decades to construct.

The vitality of Egyptian civilization was limited entirely to its beginnings. Almost every innovation in Egypt was developed during the old kingdom, which, after incorporating Sumerian technology between 3,500 B.C. and 3,000 B.C., lasted 700 years more. During this time, architectural masterpieces were built, and the Egyptians produced their own inventions.

The most vigorous art was produced in the beginning. Art became formal, stiff, and graceless near the end of the old kingdom and for all subsequent generations, except during the brief experiment with Atonism.

After the creative spurt of the old kingdom, Egypt was a living mummy which created nothing new and for which all activities centered on the preparation for death. In the 13th century B.C. the Pharaoh Amenmesses tried to change Egypt into a life-oriented, monotheistic society worshiping Aton, the Sun God, but the priestly bureaucracy subverted him and he failed. However, this was a period of renewed vigor which followed the Hyksos invasion and the consequent introduction of negative feedback into Egyptian society. But the old, tenacious, religious bureaucracy hung on in a decaying society through all the conquests of Hyksos, Assyrians, Persians, Ethiopians, Lybians, Nubians, Greeks, and Romans which followed. The conquerors found the Pharaonic cult too convenient to discard, and the priests were always ready to cooperate with any conqueror who would protect their privileges. Therefore, Egyptian civilization continued to die until it was given the *coup de grace* by Rome and Christianity. Egypt in general and Alexandria in particular were important in developing early Christianity. When the Arabs conquered Egypt in the seventh century they had no trouble imposing Islam on an apathetic population. Alexandria remained a creative Hellenistic outpost on the periphery of Egyptian entropy after a Christian mob burned the great pagan library and lynched Hypatia in the fourth century A.D., but eventually it also decayed. The unique civilization which had been Egypt fell a victim to the religion which was the source of its unique and initial creativity but also a cause for its downfall.

Rome

Rome had the same relationship to the Greeks that the Mesopotamian Semites had to the Sumerians. Rome added little or nothing to Greek culture; it merely administered it more efficiently and spread it over a wider area. The Romans were better organizers and engineers than the Greeks. They had a stronger sense of peoplehood than the Greeks. The major contribution of Rome was to spread Greek culture to the barbarians of Western Europe and to protect it in Egypt, Eastern Europe, and the Middle East. Rome had no guiding ethic other than the accumulation and consolidation of power for the benefit of the state. But the early Romans had a strong sense of honor and duty. As is always the case, power without ethical purpose corrupts without limit until it destroys. Rome became a victim not so much of religion as of a lack of ethics.

Initially the Romans were an open, reasonably democratic society. The general citizenry felt an ethical obligation to the state. Then it became a materialistic, expansionist society. The people became at first hedonistic with no objective other than pleasure, and finally then became mystical. In

the last decaying days of the Roman Empire, the Romans, particularly the upper classes, were obsessed with mysticism, magic, the occult, and other escapist fantasies just as had been the Babylonians in their days of decline, and as were the Sumerians, Egyptians, Greeks, Indians, and Chinese in their decline. Many civilizations become mystically specialized when they go into final irreversible decline. Mysticism without science is an evolutionary deadend.

It was at this time, the fourth century, that Christianity, which was popular among the lower classes, became the official religion. The Emperor, Constantine, the son of a Christian slave woman who had been a concubine to a Roman general, found it expedient to use Christianity to control his rebellious troops, who were largely Christianized. He thereby consolidated his not-too-firm hold on the Empire. Christianity came too late to save Rome from barbarian conquest, but it came in time to save Greek philosophy and hybridized Jewish ethics for Western civilization.

Western Civilization

What gives any civilization its unique character and direction is its ethicoreligious system. Technology itself is easily transferable, if not easily invented. Western civilization, as we know it today, was shaped and continues to be shaped by Christianity. On the surface Christianity controlled the masses in the same way as had the Pharaohs—by promising them immortality and eternal happiness in a heavenly paradise, if they obeyed the Church hierarchy. If they disobeyed the Church hierarchy, they were promised damnation to a hell of eternal, hideous torture. Once this ideology spread through the Roman world and its barbarian periphery over a period of about 700 years, it became a most effective unifying force, just as it had been in Egypt. Even kings and princes bowed to the authority of the Church when they were threatened with excommunication and eternal damnation—though not always, since there are always skeptics in any civilization.

When skeptical Holy Roman Emperors defied Popes Innocent I and Innocent II in the 13th century, they found that their own vassals and subject kings and princes would not obey them because they feared excommunication even if the Emperors themselves did not. Therefore, kings and emperors had to obey the Pope, if for no other reason than that of political expediency.

The same barbarian conquerors who had destroyed the Roman Empire in a series of waves, until Rome itself was sacked by Alaric and his Visigoths in 460, were in turn Christianized and became subject to Church control. This is the same pattern followed by the conquerors in Mesopotamia and Egypt. We note that when persons are brought into close, prolonged contact with an emotionally more satisfying religion advocated by a

culturally superior people, they will voluntarily convert to it unless they have a highly ethical religion themselves. The only dangers to the hegemony of the Church were rival religions which made the same or better promises and which could, as a consequence, get control over the population. When such religions would arise, usually produced as variants on the Christian faith by a Christian priest, the Church hierarchy would merely denounce this as heresy and imprison or, more commonly, kill the heretics involved. This effectively destroyed any negative feedback to the religion until the rise of Islam.

Islam

Islam played an important role in the development of Western civilization by (1) serving as a source of negative feedback to Christendom and (2) transmitting ancient Greek and Chinese knowledge plus Hindu mathematics to the Christian countries. The so-called "Arabic numerals" as well as algebra were Hindu creations, which the Islamic Arabs adopted and then further developed. Trigonometry was a late Greek invention produced through the school of Alexandria. Therefore, the Islamic Arabs for all their military vigor were fundamentally not significant technological innovators.

Starting in the seventh century the Islamic armies swept all opposition before them, and by the end of the eighth century they were the inheritors of the Persian Empire as well as a large piece of the Roman Empire.

The more civilized Persians quickly replaced the Arabs as the intellectual leaders in Islam once they had become Muslims. The major Persian contribution was the creation of ethical mysticism through Sufism, particularly the transcendent poetry of Rumi. But this was an anergistic hybridization which destroyed the ethical Zoroastrian civilization and increased Islamic entropy. The defeated, converted Persians brought a mystical, fatalistic element which corrupted the basic simplicity of Islam and turned it into another evolutionary deadend, as Omar Khayyám's poetry shows:

> 'Tis all a chequer-board of Nights and Days
> Where Destiny with Men for Pieces plays:
> Hither and thither moves and mates, and slays,
> And one by one back in the closet lays.
>
> • • •
>
> The Moving Finger writes; and having writ,
> Moves on: nor all thy Piety nor Wit
> Shall lure it back to cancel half a line,
> Nor all thy tears wash out a Word of it.
>
> —from *The Rubáiyát*

Only in Islamic Iberia, in the high-feedback environment of competing Christians, Jews, and Moslems, did human knowledge continue to advance significantly in the Western world.

When the Eastern Roman Empire split ecclesiastically from the Roman Church in the 11th century, it continued as a repository of ancient knowledge; but it became another fossilized, uncreative civilization with a huge, corrupt religious-political bureaucracy living on its past glories, slowly crumbling before the onslaught of Islam until it was destroyed and conquered by the Ottoman Turks in the 15th century. In the meantime, the Arabs became inheritors of Byzantine science and technology, particularly the school of Alexandria. The Ottoman Empire represented the height of Islamic power long after Islam had become a destructive force which created nothing and destroyed ethical intelligence through psychosocial specialization, i.e., specialized mysticism and fatalism. Although the Arabs had cherished Greek knowledge and improved upon it, the Turks nearly destroyed it when they burned the library of Constantinople (modern Istanbul).

The appeal of Islam was in its basic simplicity. There was but one God, Allah, and Mohammed was his prophet. Mohammed was the seal of the prophets and no one had anything more to add to his revelation (violates E.P. 6). His alleged revelation included an all-encompassing ritualistic way of life (violates E.P. 4), which one either had to totally accept or totally reject. Those who accepted it eventually closed their collective mind to new knowledge and became evolutionary deadends. Islamic civilization never produced any significant technological innovations. After the thirteenth century in Spain, it did not even produce any significant improvements on what already existed. However, it took the Christians almost 1,300 years before they totally dominated Islam, after the defeat of the Ottoman Empire in the first World War.

Christianity developed more slowly than Islam but more surely. Until the 13th century, Islamic civilization would have appeared to any casual observer as clearly superior to Christian civilization.

Islam led in many types of technology, mathematics, medicine, chemistry, astronomy, and architecture. It produced more wealth and embraced more people and territory than Christianity. Its physician-philosophers, such as Avicenna in Persia, then Averroes in Spain, incorporated the Aristotelian tradition, and made philosophical and medical contributions of their own. Islam was more religiously tolerant than Christianity and would allow Christians, Zoroastrians, and Jews to live within its confines with relatively little harrassment other than extra taxes. Yet it was Christendom that was to occupy the upper rung of the evolutionary ladder and not Islam. The reason was ethical.

The ethical position of Islam was simple. One obeyed the Koran fully and totally or one was outside of the pale. There was nothing that one could

contribute of an ethical nature to the Koran. Mohammed by his own alleged words was the seal of the prophets. The Koran itself incorporated sound ethical principles derived from Judaism and to a lesser extent from Christianity and Zoroastrianism; however, it was extremely destructive to believe that any revelation could possibly incorporate all important truth. Yet this is what the devout Moslem was forced to believe. It destroyed his imagination with certitude (violates E.P. 6). It closed the spirit as well as the mind. All closed systems have irreversible entropy. Islam degraded women, violating the second Ethical Principle. Islam also promised an eternal paradise of unbridled hedonism after death to the faithful, particularly those who died in battle while propagating the faith. This tended to induce pseudoethical behavior as a means to an end, not as an end in itself, thereby reducing the true evolutionary ethical effect of the religion (E.P. 4). Any ethical system which uses reward and punishment to control its adherents destroys their true ethics. The only enduring ethical contribution of Islam may be in the Sufi tradition of rational, mystical inquiry into ethics, but even Sufism seems too mystically specialized to have a significant impact on human progress.

Christianity

As the ethical foundation of Western civilization, Christianity was a true fusion and synthesis of much that was best and worst in Greek philosophy and Judaism, as well as elements of Zoroastrianism. It had the ethical base of Judaism in the Golden Rule, "Do unto others as you would have them do unto you." It also had the intolerance of Judaism toward other religions and deviant, not necessarily destructive, behavior. It had the analytic, rational tradition of Greek philosophy, but it also had some of the fatalistic mysticism of the Pythagoreans and the pathological antisexuality of the Platonists (came directly from Saint Paul). This led to the view that women were less worthy than men, e.g., women were not admitted to the priesthood. However, women were not degraded as in Islam. Therefore, Christianity was to have mixed results. What was best in Christianity came directly from the teachings of Jesus. What was worst came primarily from the teachings of Saint Paul and the bureaucracy that succeeded him.

The teachings of Jesus are simple, direct, and extremely ethical, i.e., in harmony with the evolutionary ethic and the Eight Ethical Principles. They are summarized in the Sermon on the Mount. They were made even more succinct shortly before Jesus' death. Near the end of the Gospel of John, when he is asked by his disciples what commandments he leaves them, he gives them only one commandment: "This is my Commandment, that ye love one another as I have loved you." He again almost immediately repeats, "These things I command you that ye love one another" (John 15:12, 17). The only ambiguity is what Jesus meant by "love." However,

his life explains his meaning of love. He taught and spoke the truth; he gave negative feedback sometimes through harsh criticism to persons who were destructive; he judged acts, not persons; he healed the sick; and he fed the hungry. Above all he taught that we should forgive and love our enemies, an extremely radical teaching among Jews, Greeks, and Romans—although 600 years earlier Buddha had taught that we should always return good for evil. This is a practical and emotional equivalent to the evolutionary ethic that we must maximize creativity. We maximize creativity by doing our best to increase the ethics of all persons, including our enemies (i.e., destructive persons), and the intelligence of ethical persons (remember, $C = IE$). To love a person is to do one's best to maximize that person's creativity. Yet how many self-proclaimed Christians have loved their enemies? How many alleged Christians have been Christians out of a fear of hell and a promise of heaven?

The basic corruption of Christianity came from using punishment (hell) and reward (heaven) as a means of controlling human behavior. Means which are not ends are never ethical. The essence of ethical behavior is that it must be pursued as an end in itself without fear of punishment or expectation of reward. Otherwise the religion quickly degenerates into inducing pseudoethical behavior and empty ritual. Those conditioned by reward and punishment will then substitute repetitive rituals for ethical behavior and in the process destroy their creativity. This happened to both Islam and Christianity.

Christianity was much more open, ethically, than Islam even if it was less tolerant of religious competition. It did not assume that revelation ended with the life of Jesus. Indeed the Church hierarchy was constantly interpreting the Scriptures and deducing new norms of behavior. Sometimes this was done by sincere theologians, such as Thomas Aquinas, who wanted to better understand the Will of God. At other times, it was done for economic or political expediency, as when the Church hierarchy would sell indulgences so that persons could, in effect, buy their way out of purgatory—a temporary hell for Catholic sinners who were repentant—or when the Church hierarchy would excommunicate an otherwise ethical Christian king who would not toe the line. Therefore, the Christian religion, unlike Islam, was constantly evolving. The Christian Church also reproduced, first during the East/West schism in the eleventh century and then on a larger scale after the Reformation in the sixteenth century. It should be noted that although Islamic sects did form, the interpretation of the Koran remained essentially the same in them. It was mostly the interpretation of who was the legitimate inheritor of Mohammed (the Caliph or Imam) that changed. The Koran itself was rigid and eternal. It did not evolve and neither did Islam. We recall that in order for a system to evolve by natural selection it must remain open by mutation, reproduction, and death. Christianity had these features. Islam did not.

Once the barbarian hordes were contained and Europe was totally Christianized, except for Spain and Portugal by the eleventh century, the Catholic Church became a highly progressive force—unifying people, educating, building magnificent cathedrals. The latter elevated the human spirit and formed the basic force for research and development in science, art, and technology.

From long before the time of Thomas Aquinas (13th century) considerable intellectual energy in the Greek tradition went into theological analysis of Catholicism; this was much less true of the Eastern Orthodox Churches, which focused (specialized) more on mystical contemplation than analysis. Although theological analysis was often an empty exercise, it developed the analytical skills of educated people (mostly priests) and stimulated them to look in new directions, primarily by analyzing the nature of God and ethics. All the great European universities were formed originally as theological centers which combined the Greek analytic tradition with the Jewish tradition of religious interpretation.

The closest thing to theological analysis that has objective ethical value, as opposed to the subjective value of theology, is mathematical analysis. Therefore, mathematics began a rapid development in European universities in complete harmony with theology. Both mathematics and theology could analyze the nature of infinity and the philosophical basis of truth as did Thomas Aquinas. By the 15th century, the Europeans were clearly ahead of the rest of the world in mathematics.

The science which most easily lends itself to mathematical treatment is astronomy. Furthermore, astronomy was considered important for navigation, calendar making, and, ironically, also for astrology, a widespread pagan belief inherited from the Babylonians and officially condemned by the Church. According to astrological theory, if one could predict precisely the paths of the planets, one could also precisely predict the future. (Many intelligent, educated persons still believe this objectively false nonsense, particularly in regard to personality development and how the planets affect certain personalities at birth and in the future.) More objectively important, if one could determine one's position precisely relative to a fixed group of stars at a given time, one could navigate precisely. Considerable effort thus went into the development of mathematical models of the solar system and the construction of precise clocks and observational instruments, eventually including the telescope and the sextant. This in turn led to mathematical treatments of simple physical phenomena, such as the movement of a pendulum, which in turn led to better clocks. Once this line of inquiry began, there was no end to it. It soon became clear, or so it seemed, that with enough time and effort all the physical universe could eventually be understood, predicted, and controlled through the application of mathematics, science, and technology. The Greek philosophical spirit had been rekindled again but with a new and very important twist.

Greek philosophy sought explanations which were merely reasonable in view of what men knew, or could imagine. The systematic science that was gestating in Europe sought explanations not merely that were rational and aesthetically appealing, but which had practical results. That is, they had to improve one's ability to predict and control in the objective world. This produced an interplay between science and technology in which each reinforced the other. Note that science predicts the environment and technology is a process for using science to control the environment. By definition, what scientists (called natural philosophers until recent times) wanted to do was to increase objective truth. (See figure, page 204.)

An emotionally or theologically more satisfying scientific model would be sacrificed if another model made better predictions. For practical, not theoretical reasons, the Church-approved model of the geocentric universe did not make as good predictions of astronomical events as did the heliocentric model. Therefore, the scientific paradigm said the Church must be wrong. This drove one more nail into the coffin of the Catholic hierarchy, particularly since the Inquisition foolishly persecuted Galileo for his heliocentric model and made a martyr out of him. The other nails had been driven by theologians.

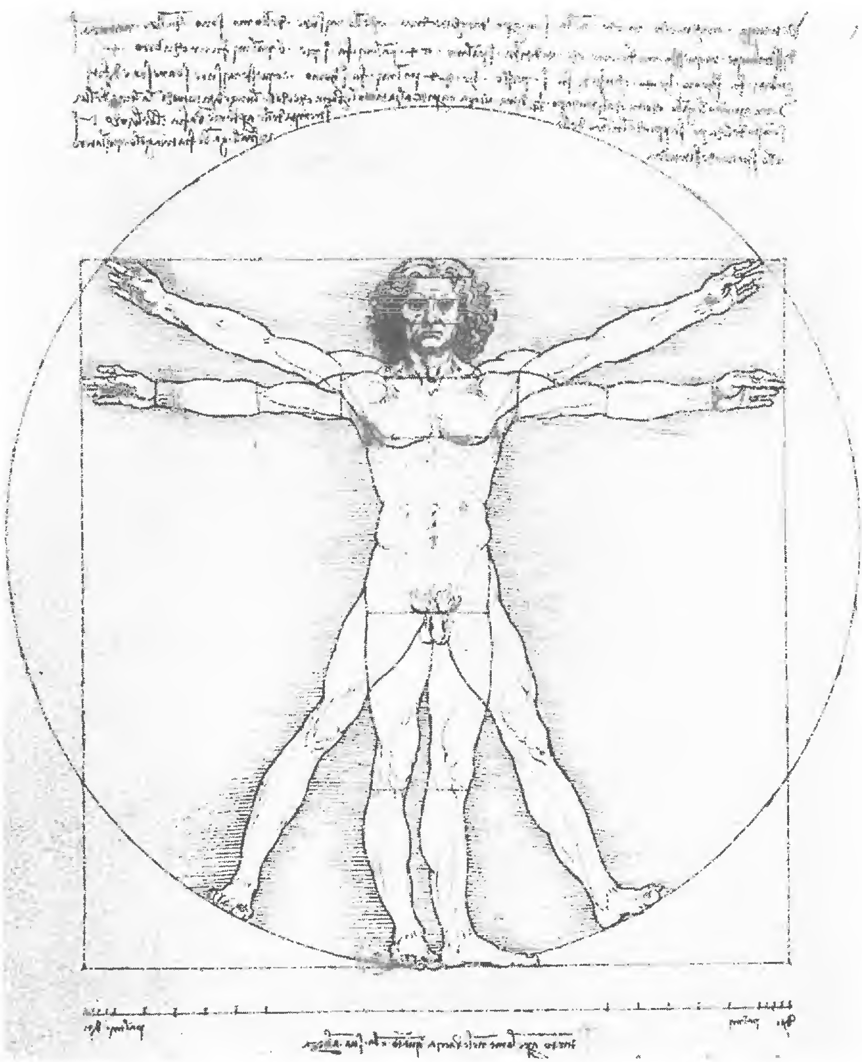
As the Europeans were slowly developing scientific knowledge and questioning the nature of the universe, the theologians had carried theological analysis to its logical conclusion and were questioning all interpretations of the Church. The Church propounded and the good Christian accepted the ethic that truth was good and falsehood was evil. This gave Christianity an ethical basis. Christianity also conserved the teachings of Jesus in the Bible, although it did not follow the prime commandment of Jesus to love everyone including our enemies.

The literal-minded and primitively ethical northern Europeans, unlike their more figuratively-minded, sophisticated, and possibly more ethically degenerate southern European cousins, could not quite reconcile the notion of the Scriptures as the literally-true revealed word of God with the selling of indulgences or the absolute authority of the Pope in religious matters. When the worldly, corrupt Borgia Pope, Alexander VI, fell ill and began to order the sacrifice of oxen on the altar of Jupiter in order to cover all possible bets, the northern European clergy was outraged, while the Italian clergy was merely amused.

Furthermore, the Europeans had discovered their past and realized that at their heights the pagan Roman and Greek civilizations had been technically and artistically superior to their own, at least as of the early 14th century, and that the ancients had created their knowledge and not merely had it revealed to them. All of these forces came together and created the turmoil which was to be called the "Renaissance." The Renaissance was a purely European phenomenon in which Western civilization became European civilization.

The Renaissance

The essential ingredient in the Renaissance was the humanistic belief that man was the measure of all things and that man could predict and control his own destiny. Jesus had taught a similar notion by saying, "The kingdom of heaven is within you" and that all ethical persons were the sons of God. The doctrine of free will was, of course, also official Catholic



Man, the Measure of All Things by Leonardo da Vinci. A geometric mapping of humanity, symbolizing man's control over his own destiny.

Self-Portrait, Leonardo da Vinci (1452–1519). An introspective view of himself by the Renaissance artist near the end of his life.

dogma, but as we can see in Leonardo da Vinci's face, he really believed in the power of his will. Soon the exhilarating realization dawned on the collective mind of 15th-century Europe that they were actually producing new and better art than even the ancient Greeks had, and that they now knew more mathematics and science than anyone in history. There was an infinite universe to be understood and won, and it was within the power of humanity to do this. This realization produced the Renaissance, an ethical revolution that has not yet run its course, although the Renaissance is often considered to have ended with the death of Elizabeth I early in the 17th century. The Renaissance attitude is what makes Western (European) civilization unique and different from all other civilizations which have ever existed.

Contrast the Renaissance attitude with, for example, the fatalism of Mesopotamia and Islam, the mystical pessimism of India and Buddhism in which ultimate death is a goal, or the conservatism of Confucian China in which human harmony was the goal and the greatest wisdom was a product of the past. The Europeans of the Renaissance, without fully knowing what they were doing, embraced the evolutionary ethic and made it a part of their collective mind. This was eventually to disrupt the Catholic Church, but it was the Church itself which had made it possible by preserving and extending Greek philosophy and then by hybridizing it with Jewish ethical purpose in the teachings of Jesus.

At first the Church hierarchy viewed the Renaissance as a favorable indication of the superiority of Christianity over Islam, which produced no significant innovations after the 13th century. Islam itself had been irreversibly disrupted in the 13th century by Genghis Khan and the Turks and their descendants, who were the last wave of barbaric nomads to seriously threaten civilization. However, as is usually the case when barbarians conquer a superior culture, the Mongols and Turks became Muslims, and the Turks inherited the Arabic part of their empire. The conflict between a weakened Islam and a rejuvenated Europe came to a head in Iberia.

Islamic civilization had reached its peak in Iberia, but it had never fully conquered the Christian kingdoms. By the end of the 15th century, the Catholic kings drove Islam from the Iberian peninsula. This was the first significant inroad that Western Christianity made in the Islamic world. Eastern Christendom, except for parts of Russia, fell to the Ottoman Turks in the 15th century. Before the 16th century, it had mostly been a problem of keeping Islam at bay. After this Islam was to begin an unsteady retreat under pressure from Christian Europe and finally, with the collapse of the Ottoman Empire in this century, to retreat almost entirely from Eastern Europe.

The spirit of free and universal inquiry and creativity initiated by the Renaissance could not be contained. In the 16th century Luther, a Catholic priest, logically and most persuasively challenged the authority of the Pope. He claimed that all authority lay in the Bible and that each individual

Christian could save his own soul by interpreting the Bible according to the dictates of his own conscience and trying to follow these dictates. This was an unbearable challenge for the Roman Church, reminiscent of the Gnostic heresies. (The Gnostic Christians of the early Christian centuries were much more in harmony with the evolutionary ethic and the teachings of Jesus than the Catholic bureaucracy, but they were annihilated by Rome when Catholicism became the official religion in the fourth century [581, 639].)

The Lutheran heresy spread throughout northern Europe and was mutated in England by Henry VIII and in Switzerland by Calvin, as well as by the many other Christian sects that continued to form up to the present time. The Catholic Church found itself besieged and began to fight for its life. In the process it became more repressive than it had been, but also more dynamic. It created the Jesuit Order as an antibody against the Protestant infection. In spite of the initial negative purpose of the Jesuits, they became a major educational force for spreading Western civilization throughout the world. However, their ideological base was destructive. They were to preserve southern Europe and Latin America for the Pope at the cost of partially closing the southern European mind and making the formerly most creative people in Europe the least creative. For all their discipline, brilliance, and erudition, the Jesuits have not been particularly inventive or creative. There are, of course, notable exceptions, such as Father Pierre Teilhard de Chardin.

The persecution of Galileo marked a turning point in which the creative impetus switched mainly, not entirely, to Protestant Europe. However, now Europe had competitive Christianity and a high-feedback environment. Technical and scientific knowledge could not be kept from the Catholic countries. Even if their creativity was inhibited, it was not totally destroyed. The least Catholic of the nominally Catholic countries, France, was to compare favorably with England, Scotland, Holland, and Germany as a creative society, particularly after the secular revolution of 1789. (Now that Spain is secularizing its culture, it should regain its former creativity.) The collective mind of Western civilization was stimulated and liberated as never before. Religion became increasingly unimportant to the national purpose. And here lay the seeds of destruction. For in overthrowing religion as a motivating factor in the national life and substituting the pursuit of national wealth and power in its place, Western civilization began to loose its ethical structure.

We note that wealth is merely a special kind of power, and power is the means to control the environment, not necessarily through creativity (see Chapter 7). Europe often threw out ethics with superstition. The liberalism of Protestantism eventually made it religiously and ethically meaningless. But in the meantime, the Protestant spirit was ideally suited to the development of capitalism. Protestantism was action-oriented.

The Protestant Spirit

A person, and almost certainly a nation, which seeks to maximize creativity will increase its wealth and its power, at least in the long run; but it is also possible to increase power, at least temporarily, while decreasing creativity. This is what began to happen ever so slowly to Western civilization. The countries of Europe used their rapidly accelerating technological power to exploit first their own citizens and then peoples of all the countries in the world that had technically inferior cultures. This was aptly shown by the deplorable working conditions in the 19th century in England (the nation with the most advanced technology at the time) and even more poignantly in the Opium War with China in the mid part of that century.

In the Opium War the British Empire imposed the Opium Trade on China through military force solely for the economic benefit of British commercial interests. The British tried to salve their conscience by using the same treaty which gave them an opium monopoly in China to also give them the right to send in Christian missionaries, thereby giving a special ironic ring to Marx's dictum of twenty years later that "religion is the opiate of the masses." The excesses of capitalism were to be partially checked in democratic countries by increasing wealth and competition and to a lesser extent by the labor unions and special laws (e.g., the Reform Act in England) which supposedly protected the ordinary citizen from capitalistic predation. In nondemocratic countries, capitalistic predation was to be replaced by a new deleterious, psychosocial mutation—communism—which would promise security without freedom and in the process destroy both.

In capitalistic countries there is a battle going on now between monopolistic capital and monopolistic labor, each seeking to take maximum advantage of the other. In communist countries, a monolithic bureaucracy, which destroys all negative feedback, has taken absolute control of the society and is destroying ethics. The losers in all this turmoil are humanity and the evolutionary process. More will be said of this later.

For now we merely note that the liberation of the human spirit which began with the Renaissance also liberated a new type of predation by a new wave of Aryan-speaking people, the Europeans (the Soviet Union and the United States are more primitive outliers of European civilization), even more profound and in some cases more destructive than the initial Aryan wave begun 3,800 years previously. (For example, the Tasmanian people were totally annihilated by the British in the 19th century.) However, this time the Aryans were usually the most civilized peoples. They were to spread their newly invented technology, but not with the same ease as they had spread chariot technology. The inventive spirit which created Western technology was more difficult to communicate than the technology itself.

Some highly different civilizations were eventually able to use and then copy the machines themselves, most notably the Japanese. The Japanese were a semibarbaric outlier of Chinese civilization who absorbed Western technology in the late 19th century. However, no nation without a full European culture has yet been able to systematically invent new machines superior to those of the West. Although the Japanese were able to mass-produce Western innovations better than the West itself, the Japanese have not yet equaled Western creativity. Mao Tse Tung tried to Europeanize the Chinese by imposing his own brand of Marxism on China and destroying all vestiges of Confucianism. The more recent Chinese communist policies have led to a temporary opening of their society and a rehabilitation of Confucianism. It is possible that the creative and highly disciplined Chinese people may become technological innovators under this system, at least for a while. Eventually, Chinese communism, like any other closed, bureaucratic ideology, will destroy the creativity of China just as bureaucratic ideology has destroyed all other civilizations—by closing the mind and destroying the imagination.

The competition between human societies was to become competition in the ability to invent—not in the ability to produce or even the emotional ability to fight, as World War II and the cold war would show. Those special qualities of brain and mind that produce a creative society, as opposed to merely a cooperative and productive society, were to become of paramount importance in human evolution. By the late 20th century a situation would arise in which some societies could invent faster than their competitors could copy, as evidenced by the growing disparity in computer technology between the United States and most other countries. More innovations have been produced in the 20th century than in the entire past history of the human race. However, that creativity has been limited almost entirely to the physical and biological environment, and it is ending.

In the psychosocial environment humanity still attempts to predict and control by the same forms of self-delusion as did the Sumerians, Egyptians, and Europeans of the Middle Ages. Humanity today uses science to predict and control the physical and biological environment, but primarily ideology (e.g., religion, astrology, and fads) in the psychosocial environment. This creates an imbalance in psychosocial evolution analogous to specialization. The central problem in the modern world is that humanity cannot creatively predict and control itself. However, 300 years ago there lived a man in Holland who showed us how to create our own creativity.

Spinoza

Although morality, the ability to predict and control our own ethics, was first created by the great prophets and moral leaders of the sixth century

B.C., theirs was a basically mystical morality not fused with science. Socrates and to a lesser extent Confucius were rational but not scientific. In the 17th century Spinoza invented scientific ethics and made a true synthesis of mysticism and science.

Bertrand Russell referred to Spinoza as "the noblest and most lovable of all the great philosophers . . . ethically he is supreme" [665]. Goethe, one of the most creative men in history, read Spinoza every day and tried to guide his life by Spinoza's teachings. Einstein, when asked if he believed in God, proclaimed that he believed in the God of Spinoza. Einstein carefully studied Spinoza and used his understanding of Spinoza to understand nature and the working of the universe.

Spinoza taught that God is all that is, and that each of us is a modification in the body of God. Today quantum mechanics is confirming this holistic view of the universe. The only purpose of life, according to Spinoza, is to love God. We love God by emulating Him and understanding Him and His laws. In the process we maximize our creativity and that of our fellow humans by learning, teaching, and creating (emulating God) to the best of our ability. Spinoza derived his theories by mystical intuition combined with pure logic and mathematical reason. He used no ideology, but starting from basic axioms and definitions he derived his system mathematically, just as Newton was at the same time to derive his *Principia Mathematica.* While the latter became the first universal scientific model of physical reality, Spinoza's focus was on the reality of the human mind in its highest form. He showed every human being who wished to know that reality how to increase ethics and become moral. Yet few persons have read Spinoza and even fewer persons have understood him.

Those who have understood and accepted the teachings of Spinoza have had their creativity greatly increased, as was the case with Goethe, Einstein, and Russell. Yet others have misunderstood and distorted the teachings of Spinoza. Most notable among these is the line of thinkers—Locke, Hume, Voltaire, Rousseau, Diderot, etc.—leading to Jefferson, and the line of Leibnitz, Kant, Hegel, Marx, Engels, etc., leading to Lenin.

Spinoza first showed how a republican, free society leads to maximum creativity. But he had little confidence in the democratic process. Freedom was essential to progress, but popular democracy was not necessarily the best way to achieve or maintain freedom, since the masses were subject to the manipulation of their fears and prejudices by demagogues. Socrates had understood the same thing 2,100 years earlier.

Through various misinterpretations of Spinoza, Thomas Jefferson, who was as enlightened and ethical a leader as any nation ever had, came to the conclusion that freedom could only be preserved by a popular republican democracy in which the opinion and vote of each citizen had equal weight and that the majority could, through its elected leaders and alleged representatives, impose its will on the minority, although he favored a bill

of rights to protect individuals against majorities and government in general. This mistake led to the system of government of the United States, which represents a new civilization based on the democratic ethic. It is believed that the maximization of freedom for all persons is the greatest good. The ideology says that this can be achieved by a popular republican democracy plus a constitution (especially, the Bill of Rights) to protect the rights of dissenting minorities. What this has produced is a nation allegedly dedicated to freedom in which individual liberty is constantly diminished through ever growing government bureaucracies and corporate monopolies, which manipulate the government, together with unethically restrictive laws and confiscatory taxes, which favor the bureaucracies and the monopolies over the individual citizens. Furthermore, it is a country which supports oppressive tyrannical governments in all parts of the world as a lesser of two evils and as a means of combating communism.

Communism as well as Nazism as ethical systems can be traced directly to Hegel, who considered Spinoza the greatest philosopher who had ever lived, although he had little understanding of him. Hegel and Marx incorporated Spinoza's greatest mistake into their philosophies by seeing history as a deterministic process subject to closed modeling. Spinoza had not gone quite that far, but Hegel and Marx did. Leninist communism became the most abominable tyranny in history.

Human history is an extragenetic continuation of human genetic evolution. All evolutionary processes are nondeterministic quantum processes not subject to closed modeling. The only thing that can stop the evolutionary process is to close it, as Islam did. This is precisely what Leninist communism has attempted in the Soviet Union and other communist countries.

Communism represents a civilization based on the materialistic ethic of maximizing individual security through the ideology of government control of everything, including the flow of all information between all citizens of communist states. This rigid control of everything eventually produces ever diminishing security for a society which destroys its citizens' creativity by destroying all negative feedback and punishes them for not being totally submissive or in any way criticizing communist ideology and authorities.

Spinoza's teachings, although replete with mistakes, are highly ethical in their intent, their approach, and their conclusions. They will enhance the creativity of anyone who uses them as a base on which to build a better understanding of the evolutionary ethic. However, isolated parts of Spinoza's ethics can be misunderstood and lend themselves to perversions of the evolutionary ethic, as has occurred in the United States and the Soviet Union. Furthermore no combination of two false ideologies can substitute for the evolutionary ethic. That is why humanity desperately needs an alternative to communism, capitalistic democracy, and all combinations of the two which are inherently self-destructive. The lack of an alternative up to this time has produced the new entropy.

The New Entropy

The pattern for all civilizations prior to Western civilization was that they would begin with a creative burst and then would become bureaucratized religiously, politically, economically, and socially. In the process, they would pass most of their technological information, i.e., objective truth, not necessarily the false information of religion and bureaucracy, to barbarians or semibarbarians on their periphery. These people would then either conquer the civilization and become absorbed into it, eventually becoming corrupted, or completely destroy the decaying civilization and create a new, more vigorous one of their own. The new civilization would then repeat the process. This is natural selection at the super-metazoan level.

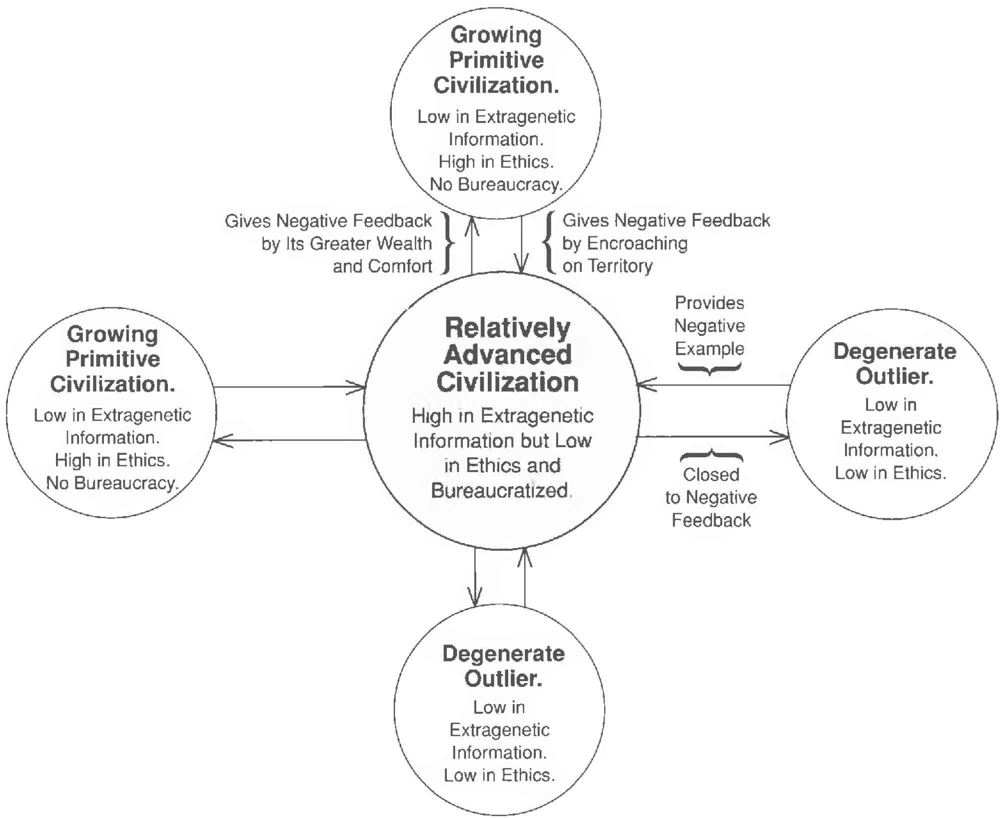
The semibarbaric outliers of the basic European civilization were America and Russia. They were each in analogous relationship to Europe as the Aryans had been to Mesopotamia or the Romans to the Greeks. Each would take the science and technology of Europe as well as a new psychosocial model developed in Europe, but incorrectly derived from Spinoza, to create a psychosocial mutation of European civilization, each more vigorous and more dynamic than the parent civilization. This in turn caused a backflow of information to Europe, which in varying degrees made Europe a hybrid of its own children.

America took the democratic ethic as the basis of its psychosocial revolution. This ethic, which originated in Western Europe, was through America's example eventually to become part of Western Europe.

Russia took as its foundation the materialistic ethic, also originated in Western Europe, and then spread it by force to Eastern Europe in a manner reminiscent of Islam. Both ethics were defective because they were means which were not ends.

The democratic ethic grew in part from the work of Spinoza, Locke, and Hume, who in turn influenced the French rationalists such as Voltaire and Diderot, and the French irrationalists typified by Rouseau. This ethic states that the maximization of freedom is the means to create a progressive civilization independently of what criterion we apply to progress. But as we have seen, the only end in evolution is the maximization of creativity. Freedom is a natural consequence of maximizing creativity; it is not necessarily its cause. A nation which suppresses human freedom will eventually destroy its creativity by destroying negative feedback, but it will not necessarily expand creativity merely by maximizing freedom. Freedom is necessary but not sufficient to maximize creativity. When freedom is used as a means to an end, it becomes an end in itself and produces an undisciplined, artificially egalitarian society which refuses to recognize creative differences and in which creative mediocrity is celebrated and creative genius is ridiculed. This is amply evidenced by the typical forms of American enter-

Feedback between High Civilization and Lesser Civilizations on its Periphery



How a relatively advanced civilization gives feedback to and receives feedback from primitive and degenerate outlier cultures

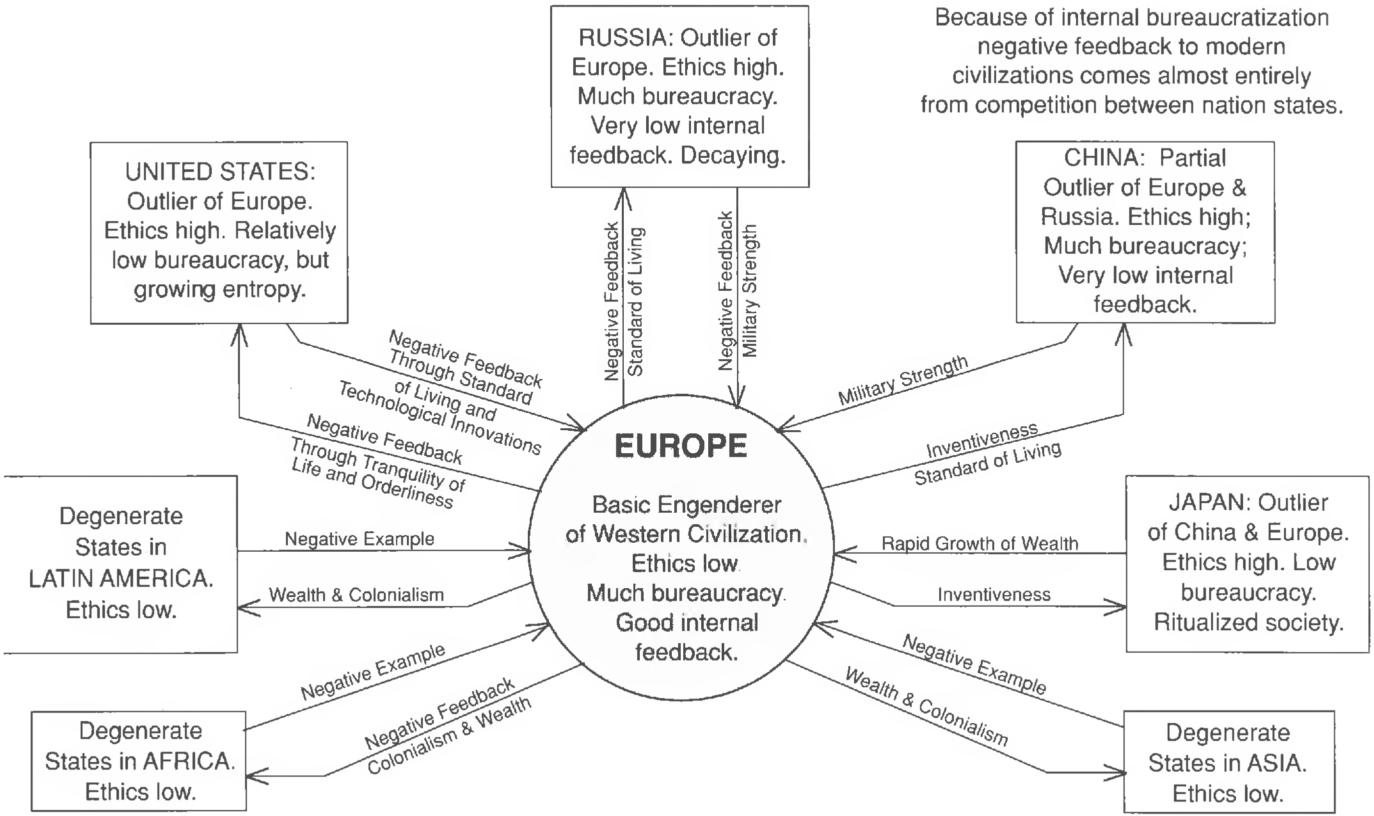
tainment, in which the hero is an anti-intellectual man of action and the creative genius is a childlike incompetent who cannot cope with practical everyday problems. The scientific evidence is that reality is actually the opposite of this stereotype [769, 770]. The damage of anti-intellectualism is to eventually produce a society of specialists who cannot integrate the physical, biological, and psychosocial sciences to ethically guide human evolution. They replace truth with self-delusion and illusionary knowledge in areas outside their specialty. Above all, the will of ignorant majorities is imposed on more creative minorities.

We see this phenomenon most clearly manifested in the United States, which more than any other country has made the democratic ethic a part of its culture. It manifests itself in political leaders who are ignorant of everything except of how to deceive the people into voting for them. They are specialists in the political technology of manipulating the basest fears and prejudices of their subjects. It manifests itself in highly specialized engineers who only know how to operate, build, and less often design a specific type of machine but care nothing about the social and ethical consequences of the uses of this machine by a corrupt political bureaucracy. It manifests itself in university professors who have learned one subject to the almost total exclusion of everything else and force students into the same specialized, uncreative mold. It manifests itself in parasitical lawyers who produce a legal system devoid of truth or justice, based on legal technicalities together with the manipulation of the fears and prejudices of ignorant juries. It manifests itself eventually by a decrease in creativity which can only be expanded by ethical persons of broad knowledge, who abounded in the Renaissance but have since then undergone a relative decline.

In spite of all these problems the United States is still the most creative component in Western civilization because personal liberty is essential to creativity. It has the best hope of remutating itself in an ethical, evolutionary direction. If it does so it will revitalize the basic European civilization and its cultural outliers, which today constitute the entire human race. The negative feedback essential for accomplishing this task is likely to come from Japan in the future; up to now it has come from the Soviet Union.

Just as the United States is the nation which epitomizes the incorporation of the democratic ethic into European civilization, so does the Soviet Union epitomize the incorporation of the materialistic ethic. The materialistic ethic grew out of the democratic ethic because it soon became clear that freedom was of little value if it only meant the freedom to starve or to be a *de facto* slave to a social parasite devoid of merit who had inherited power and wealth merely because of the creativity or greed of his ancestors. This ethic was most clearly and persuasively stated by Marx and Engels, who derived their philosophy and method from Hegel, who was in turn a devoted but incompetent and ethically perverse student of Spinoza. Therefore, the equal distribution of the wealth of society and public ownership of

Feedback between Europe and Entire Complex of Civilizations



Entire complex of civilizations is decaying; but since 1965, U.S. is decaying relatively faster than some other outliers of Europe, such as Japan. Europe is improving materially but has not matched military strength of U.S. and U.S.S.R.

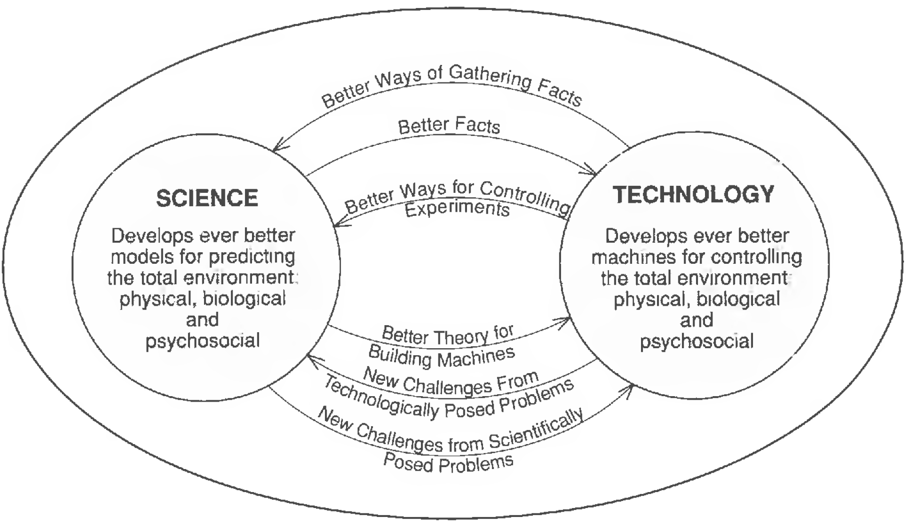
the means of production became the rallying cry of the socialistic and communistic movements. "From each according to his ability; to each according to his need." These movements were to varying degrees successful in all countries with even a semblance of European civilization. Virtually all nations give lip service to the materialistic ethic. All the immediate cultural outliers of the Soviet Union, most notably eastern Europe and China, became psychosocial mutations and hybrids of Soviet communism, sometimes through direct Soviet military force as in the case of Estonia, Lithuania, Latvia, Korea, Hungary, Rumania, Poland, Germany, Bulgaria, and Czechoslovakia, and sometimes through genuine, but misguided, internal revolution as in the case of Yugoslavia, China, and Vietnam. The Soviet style oppression in some of these unfortunate countries has ended, primarily as a result of Mikhail Gorbachev's moral courage and enlightened policies. This shows that even in the most oppressive and tyrannical of societies there is always hope of change for the better. It is always unethical to give up hope, because it is always unethical to be certain.

Communism ensured its eventual destruction by totally suppressing all dissent and criticism of the political system. By turning their countries into jails and trying to completely control all flow of information and negative feedback, communist leaders greatly reduced the creativity of their often highly creative people. By stifling the criticism from their most ethical citizens and putting them in punitive insane asylums, they became even worse than Islam and they eventually had the same fate as any closed system—irreversible entropy. Only the annihilation of communism could save these societies. If the reforms initiated by Mikhail Gorbachev take hold and are expanded, the Soviet Union and its former satellites may reverse their decline. The problem in the United States is much more subtle.

The democratic and the materialistic ethics, as well as any combination of these ethics, are inadequate foundations for a progressive civilization, since they are both means which are not ends. They do not directly incorporate the evolutionary ethic. The competition between the Soviet Union and the United States showed to each the weakness of the other. However, it is difficult for them to learn from one another because the basic weaknesses in both societies are due not so much to ideology as to bureaucracy.

Although the Soviet Union became by far the more bureaucratized of the two systems, the United States is still moving in the same direction of ever increasing government control over individual creativity. In the most important aspects of society—that is, those functions which most directly affect the expansion or preservation of creativity (e.g., education, national defense, politics, land use planning, and basic industrial production)—the two societies have relegated these activities to monolithic bureaucracies consisting entirely of government agencies in the Soviet Union and in the United States of a mixture of government agencies and monopolistic, capitalistic enterprises which manipulate the government. In the United States,

The Interactions of Science and Technology Within the Context of Human Evolution



The System of Evolving Objective Truth Composed of Ethical Beings, Knowledge and Machines

five corporations control over 90% of all production of steel; ten control over 90% of all production and distribution of petroleum and its derivatives; for many years one corporation controlled over 70% of all computer sales; less than 1% of the U.S. population owns more than 80% of all the stock in all the corporations. Therefore, the Soviet Union and the United States do not interact creatively to overcome their most important and mutual weakness, which is bureaucracy. Instead, each imitates what is worst in the other. Ideology is also a weakness in the United States, but in a less obvious way than in the Soviet Union. The ideological weakness of communism is obvious in a system that for seventy years justified constant lying and totally oppressing individual creativity not under the control of the state. This eventually produced a society so uncreative that it could not even feed itself. The Soviet Union is beginning to recognize its faults, tell the truth to its people, and reform itself. The same cannot be said of the United States.

The ideology (and weakness) of the United States derives from the almost universal belief that decisions arrived at by majority consent of the electorate are always correct and ethical. Freedom is a valid goal. The democratic process guarantees the eventual destruction of freedom. Science and history show that majorities are almost always wrong in making complex decisions and judgments. The tyranny of a majority is just as

destructive as the tyranny of a minority. Every form of tyranny is unethical.

In the United States a majority of the electorate is ignorant, anti-analytic, and uncreative because of a totally bureaucratized educational system—which is remarkably similar in all countries, irrespective of their ideology. It is a system that uses fear through reward and punishment to condition its students to regurgitate old information instead of creating something new, and in the process destroys their creativity along with their ethics. As a consequence, the American electorate can be easily manipulated and deceived by a slightly more intelligent and unethical political bureaucracy. Therefore, the freedom of political choice is an illusion. All the options are controlled by those who spend billions of dollars to manipulate the majority through lies and misleading emotional appeals to their most irrational fears and prejudices. This manipulation is done primarily through the hypnotic medium of television, which Americans spend an average of fifty hours per week watching. A large majority of American adults read nothing, not even newspapers. Through television and the destructive educational system, a large majority of Americans have become intellectually passive as well as ethically inactive; they have lost the capability even to reason analytically, let alone think creatively. These Americans are the electoral majority, who are manipulated to impose their will on more creative minorities. Eventually it becomes almost impossible for anyone who is not totally venal to be nominated, let alone elected, to any political office. A majority of the electorate repeatedly vote only for candidates who deceive them by speaking the lies that the majority wish to hear. Candidates, who speak the truth, are ethical and creative, are universally rejected even before the nominations. Therefore, they often stop trying. In the words of Bertrand Russell, "democratic electorates eventually elect only persons who are stupid, hypocritical or both." Repeatedly the electorate is induced to vote to cut its own throat, e.g., real estate, tax, and educational laws. The most evil liars in the nation become the political leaders.

Part of the problem is that persons who want power over others should never have it, and only persons who want power run for office. Creative persons value creativity, not power over others. Therefore, they pursue creativity, not power. Only unethical persons see power as an ultimate goal, because they have no confidence in their own creativity. No nation has yet devised a system that prevents all power from eventually concentrating in the hands of those who focus on the pursuit of power. (We will show how to bring about such a system in the following chapters.) Still, in spite of its defects and entropic course, a great deal of personal freedom is guaranteed, although not always given, by the U.S. Constitution. This allows some independent educational, social, and economic experimentation to coexist within an increasingly bureaucratized and tyrannical United States. In this there is great hope for humanity.

Through fear of one another the Soviet Union and the United States have come close to annihilating humanity through nuclear war, pollution, and other means [280]. The Soviet Union has begun to reform itself, although these reforms have not yet significantly debureaucratized Soviet society. Nor do we know how long they will last. But the Soviets have at least let some of their eastern European satellites free themselves and throw off the communist tyranny. However, it will take many more reforms for these highly creative peoples to regain their former creativity. Germany, Czechoslovakia, and Hungary, who have most repudiated socialism, have the best immediate prospects. The American experience should have taught Gorbachev that *glasnost* would work better than *perestroika*.

Glasnost has led to new feedback in Soviet society and its former satellites. If the Soviets refrain from future military intervention, all the former satellites and probably the Soviet Union itself will eventually be transformed into social democracies like the rest of Europe; Leninist communism can endure only through brute force against the will of almost all ethical people. Social democracies are less entropic than communist nations, but not maximally creative. All power to inhibit individual creativity must be taken from all governments, if creativity is to be maximized. Democratic socialism is inherently unethical, unless it is totally voluntary and not imposed by a tyranny of the majority. Only mutually desirable transactions through 100% consensus can ever be ethical or creative. Democracy leads inevitably to social democracy through the unethical manipulation of the fear of the majority and their hatred of the rich. This is moderated only because movements toward *laissez-faire* capitalism make the majority richer, and confiscatory socialism ends up, eventually, distributing only poverty, as was the case for the communists. It will be shown in Part II that voluntary socialism by 100% consensus of all participants cannot function practically in societies much larger than four cooperating families. Since confiscatory democratic socialism, whereby the relatively poor majority takes private property by force from the relatively rich minority, violates the personal human rights of the minority, it is an unethical system that will eventually destroy itself, just as communism already has.

The only ethical way to overcome bureaucratic entropy and begin *perestroika* in any society is to take away the bureaucracy's power over individual creativity, and empower individuals through ethical *laissez-faire* capitalism within a free society. Not even the United States, another social democracy, seems capable of doing that. What all governments have shown is that no government can ever be trusted, because all governments are dominated by persons who value power over creativity. That is why "that government which governs least governs best." Those who value human evolution and wish it to continue must change the world by first changing themselves, so that they become maximally creative as individuals and as independent groups outside the bureaucratic system. This process is called "Creative Transformation."

PART II

The Quantum Perspective

Pierre Teilhard de Chardin (1881–1955). The Epitome of a Creative Scientific and Artistic Mystic, a Spiritual, Scientific Generalist. (Photograph by Philippe Halsman.)

CHAPTER 5

The New Synthesis

In Part I of this book I developed a rational, evolutionary perspective of the universe and our place in it, basing my exposition on generally accepted, well-understood facts with logical, speculative extrapolations from these facts. The extrapolations, although possibly radical to some, were in the spirit of scientific tradition, with few or no mystical components. I am now going to deviate from that tradition and bring in mystical components which are in harmony with scientific facts. This is something which is generally not acceptable within scientific discourse.

I have learned through personal experience that the creative process is not purely logical or linear. It involves irrational, nonlinear, and diffused thinking which makes apparently irrational jumps between many apparently unrelated topics. Eventually, this type of thinking and perceiving must become focused and subject to objective, rational analysis, or it is very likely to lead to self-deception. If we are to be maximally creative we must learn to combine rigorous scientific thinking with diffused mystical thinking.

We create through diffused, intuitive, mystical thinking. That type of thinking can also lead to gross self-deception. We separate truth from illusion through science. In this chapter—and to a lesser extent in the chapters that follow—I shall try to bring about a synthesis between these two types of often antagonistic mental processes by deriving the Creative Transformation process not linearly and logically, as I derived the evolutionary perspective, but rather subjectively and personally, as the process actually became understood by me. This involves sharing my subjective experiences with the reader as well as sharing the objective facts that led to these experiences. To the best of my knowledge this has never been done successfully. However, it would be misleading to give a linear, logical derivation of Creative Transformation when the linear logic of the process occurred to me only after I derived it. I hope that by my taking this risk, you will benefit. If I fail now, you and I can both try to derive the Creative Transformation process rigorously, linearly, and logically in future books about this new synthesis.

The new synthesis is a twentieth-century phenomenon by which all fields of knowledge are converging to show that physical, biological, and psychosocial evolution are different facets of a single cosmological process. The new synthesis begins in this century with Einstein, who through his understanding of the ethical teachings of Spinoza was able to get new insights into how the universe is structured. Since Einstein, many persons have contributed to the new synthesis. We will discuss some of them later. The thinker who most exemplifies the new synthesis is Pierre Teilhard de Chardin.

Pierre Teilhard de Chardin

Teilhard was born in France in 1881 to an aristocratic family. He was ordained a Jesuit priest in 1912, but volunteered to be a stretcher-bearer in World War I. He was decorated for valor and received the Legion of Honor. He became a world-famous paleontologist. In the 1930s he was one of the discoverers of Peking Man, the first known complete set of fossils of advanced *Homo erectus*. In addition to his more conventional scientific activities he was a philosopher of evolution who made the first complete, modern synthesis of science, evolution, ethics, art, and mysticism. Spinoza had made a more rigorous but less complete synthesis 300 years earlier. Teilhard wrote many beautiful books on these subjects [759–768]. Almost all of them were banned by the Catholic bureaucracy. However, they were published after his death in 1955 while in "exile" in New York City. I had the privilege to encounter Teilhard once in Berkeley, California, around 1953, a few years before he died. Crossing paths on a campus walk, we smiled at one another and said "hello" but did not otherwise speak. I did not know who he was at that time, but that incident stayed with me and profoundly affected me for the rest of my life. I felt I had encountered a remarkable man and always regretted that I did not attempt a conversation.

Teilhard's best-known book is *The Phenomenon of Man* (*Le Phénomène Humain*, a much better title in the original French) [767]. In it he speculates that evolution is a process leading us toward convergence with God at a point he called Omega. Many persons, including me, have been deeply moved by Teilhard, and I was an anticlerical agnostic when I first read him, not knowing he was that impressive person I had encountered sixteen years earlier. Yet Teilhard is decreasing in popularity. Part of the problem is that as a total generalist, i.e., a full scientific and artistic mystic, he was misunderstood by both the scientific and the humanistic communities. He violated some of the prejudices of each. The scientific bureaucracy takes any apparent error in an argument as reason for discarding the entire argument, even if it leads to obviously correct conclusions. Scientists are also highly prejudiced against the introduction of any form of mysticism to any scientific discussion. Specialists in any field always try to discredit gen-

eralists by latching onto any error they make in the former's specialized fields. They always miss the forest for the trees. That is why specialists are minimally creative. We cannot create when we fear error. Science can always eliminate our errors.

The major value of Teilhard, as with Spinoza and other scientific mystics, is not that he is correct in all his details but that the beauty and completeness of his synthesis can stimulate the imagination of others to perfect his vision in an unending process. The tragedy of Teilhard is that his vision was not practical—indeed, less so than that of Spinoza. He showed us from where we came, how we got here, and where we are going; but he did not tell us how to take the next step. He left thousands of persons ready, willing, but unable to take the next step. What happened was that eventually a cult, dominated primarily by self-deluded, mystical specialists, took over the Teilhardian movement and further alienated the scientific community. One of the effects of Teilhard was to stimulate many other persons to explain and amplify his vision. This led me to write my first book on these subjects, *The Moral Society*, in 1970 [280].

The Moral Society

In this book it was my twofold objective (a) to perfect the vision of Teilhard by amplifying it through my presumably more extensive and deeper knowledge of mathematics, physical science, and technology, and (b) then to make it practical both through my knowledge of the real world and by purging it of all mysticism, ideology, and sentimentality. My intent was no less than to write a book that would replace the Bible, the Koran, and *Das Kapital* as motivating factors in human history. I was much less successful at it than Teilhard.

My youthful arrogance might be forgiven in light of the facts that at the time I was a very successful, 34-year-old high-technology entrepreneur and scientific generalist who had many inventions to his name and had for two years been the founder, chairman of the board, and president of a fast-growing, highly creative engineering company that was destined to earn hundreds of millions of dollars. As with many Americans, I thought that having achieved financial and technical success I now qualified as an "enlightened master." However, as soon as I saw myself becoming wealthy and powerful I realized that this would not fulfill my life or give meaning to my existence. Indeed, it was a trap. What moved me and gave meaning to my life was the vision of Teilhard and Spinoza and its restatement by me in *The Moral Society*.

The first thing I did after I finished *The Moral Society* was to give copies of the manuscript to my closest associates, many of whom I had greatly enriched and all of whom I respected. I was astonished by the results. All of my senior coworkers claimed I had personally betrayed

them. Not only were they afraid that my book would bring down the wrath of the government on us and destroy our company, they almost all refused even to discuss whether my book was right or wrong. That apparently was irrelevant. Further, it was obvious from the few comments I did receive that they grossly misunderstood my book, which I had taken great pains to make clear, concise, and simple enough for an intelligent high school graduate to understand. I did not yet understand the nature of fear or how fear induces self-deception and misunderstanding of significant negative feedback. Therefore, in order to fulfill my fiduciary obligations, I sold all my stock in my company to my employees for whatever they wished to pay me, under any terms they wished, feeling very noble in the process, and set forth to conquer the world for the evolutionary ethic. I received enough to support my family for two years. I had a wife and four young daughters to support. Therefore, I felt some fear, since it occurred to me that in giving up my economic base I might have much more in common with Don Quixote than with Spinoza. I strongly identified with Spinoza and to a lesser extent with Teilhard at this time. Along with my feelings of nobility there were shadow feelings of foolishness, smugness, and self-righteousness.

I had never known failure before and had an exaggerated self-confidence in my creativity from having already achieved technical and economic success, as well as from having made a full commitment to the Game of Life. I was burdened by a little knowledge. From this moment on, however, I would, in a sense, know nothing but failure for the next fifteen years. My vision of the Moral Society was that of a super-metazoan, collective moral intelligence that would have the same relationship to us as individuals that we have to an amoeba. Furthermore, I had a completely practical, rational, scientific, step-by-step program of how to transform our current society into the Moral Society. I also had about a thousand self-declared supporters, after the book was published, who claimed to be ready to help me take this quantum leap in evolution. Yet everything I tried failed. We could not even take the first step.

My main concern when I wrote my book was that it not lead to another destructive, dogmatic ideology as the Bible, the Koran, and *Das Kapital* had. Therefore, I constantly stated that my ideas, just like Teilhard's and Spinoza's ideas before me, might be partially wrong and should be modified whenever scientific feedback so indicated. With the negative examples of St. Paul, Mohammed, and Lenin before me I did my best to assure that each embryonic Ethical State that I started would abort if it became destructive. The Ethical State was to be a transition state between our current society and the Moral Society. Each of the dozens of experiments in which I tried to create an embryonic Ethical State led instead to an incipient bureaucracy that had to be aborted.

I tried one thing after another. Nothing seemed to work. I could not create an organization that would not become a bureaucracy, even though I

knew exactly what caused bureaucracies and the necessary basic mechanisms for preventing them. It was not until 1984 that I was to discover the cause of, although not quite yet the solution to, the problem. The cause was *fear* and the self-deception induced by fear.

So long as persons are driven by fear they will turn any organization they belong to into a bureaucracy. Indeed, an alternative definition of a bureaucracy is an organization that instills fear into its members by convincing them that they cannot create, but must live parasitically off the creativity of others. Fear is the belief that we cannot create.

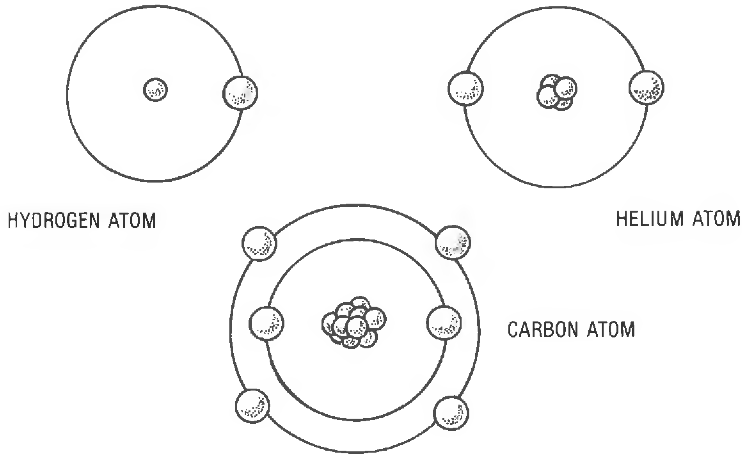
The only antidote to fear is love. Love is the desire to help and act of helping another person increase his/her creativity.

The reason I had been failing for fifteen years was that I did not understand the nature of fear and had been lacking in unconditional love. The latter was a quality in which Teilhard put me to shame. I did not even know how to love my friends, let alone my enemies. I mistakenly thought that a cool, rational commitment to the truth was sufficient. I could not help those I loved overcome their fear. As a consequence, I could not overcome my own. I had to correct my mistakes if I was to help create a Moral Society. We could not take the first step until we changed ourselves. An Ethical State not unified by unconditional love is a contradiction in terms. I learned to correct my fundamental error in an indirect way by observing two patterns in nature, while trying to better love others unconditionally and to transcend the belief that I could not love creatively.

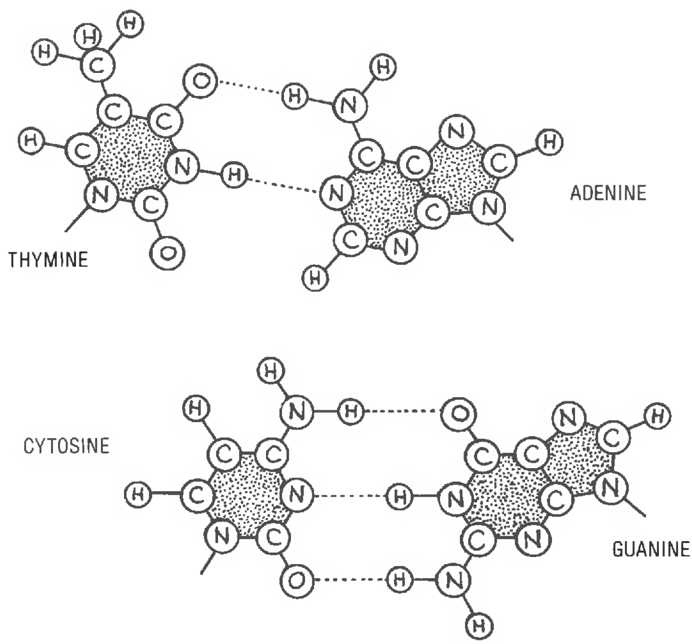
An Objective Pattern

A proton and an electron are a complementary pair that together make the simplest atom—hydrogen. Four complementary pairs of protons and electrons, i.e., four hydrogen atoms, when fused, make a helium atom—which is the first step in atomic evolution. This is the most common isotope with two electrons, two protons, and two neutrons. (A neutron is essentially a fusion of an electron and a proton.) Over 99.99% of the helium isotopes are in this form. The fusion of helium leads to carbon and to many other atoms. The carbon atom is the only completely generalized atom, being equally an electron donor and an electron receiver for all its four valence electrons. In its most common isotope, it consists of four complementary pairs of active electrons and active protons. The other eight electrons and eight protons are neutralized in an inner helium atom plus four additional neutrons. Furthermore, carbon is the atom which forms the basis for chemical, as opposed to atomic, evolution—the next hierarchy in the evolution of matter.

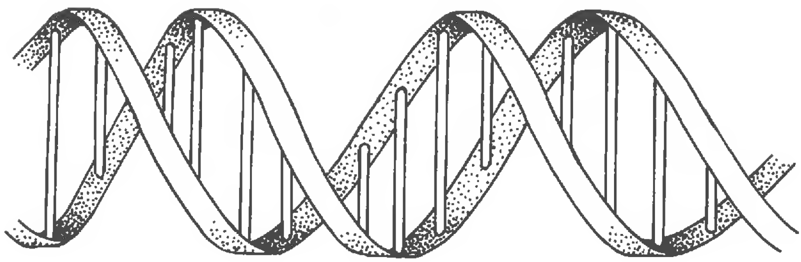
Chemical evolution eventually leads to the four nucleotides—guanine, thymine, adenine, and cytosine—which make up the genetic code within the DNA molecule and which organize themselves as four comple-



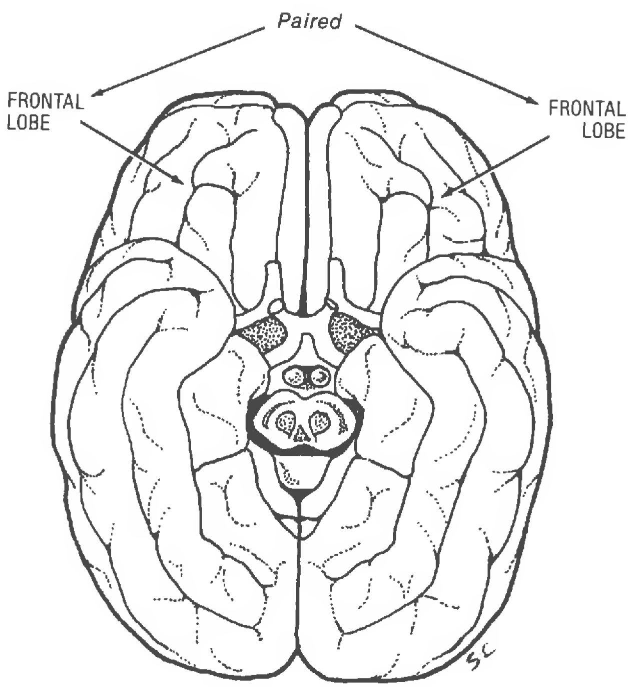
Models of atomic complements



Models of molecular complements



The DNA molecule is a complementary pair; each strand of the helix mirrors the other.



Ventral view of the human brain, which consists of four pairs of complementary brains: fish, reptile, early mammal, human (see also p. 127).

mentary pairs along the DNA strands. The DNA is itself a complementary pair. (Note that thymine is slightly altered into uracil when messages are sent from the DNA to the ribosome by T-RNA.) Four complementary pairs of simple DNA and simple protein in autopoietic interaction are probably what created the simplest living cell, which may no longer exist.

Cells are the beginning of life and human beings are the highest known form of life. What produces human ethical intelligence and makes us fundamentally different from all other life forms is the human brain. Furthermore, the human brain consists of four complementary pairs of subbrains.

Each cerebral hemisphere is a complement to the other, the now famous left-brain/right-brain interaction. The highest and most recent brain is the neocortex, the fourth brain. This is the center of ethics and imagination. The next or third brain is the mammalian cortex, or the limbic system, the center of the emotion of love and its variants plus the higher biological drives. The next or second brain is the reptilian complex, the center of fear, rage, and aggression plus intermediate biological drives. The first and oldest brain is the fish brain, i.e., the rest of the nervous system, which is the basis for the most primitive biological drives and the automatic control of our basic physiology. The human brain is an autopoietic system of four complementary pairs which makes it possible for humanity to take the next quantum leap in evolution.

Speculative Extrapolation

Evolution goes in quantum leaps by integrating first complementary pairs, then successive hierarchies of four complementary pairs. At the human level the male and female brains are complementary pairs. Recent embryological and neuroanatomical studies support the existence of complementary differences between males and females [877-904]. Until the advent of *Homo sapiens* no species had a fully developed set of four paired, complementary brains. It might require only the ethical integration of four men and four women to create an embryonic Ethical State. Within this context an Ethical State is a new level of moral consciousness and collective ethical intelligence. The moral integration of four complementary pairs of Ethical States might create an embryonic Moral Society.

An Ethical State is therefore a new state of mind that comes to exist among four men and four women who simply make a commitment to maximize each other's creativity by engaging in a new form of autopoiesis. If this represents a valid extrapolation of the objective pattern in nature—by which quantum leaps in evolution occur through successively higher orders of autopoiesis between new hierarchies of four complementary pairs of evolutionary entities—then a new, higher form of creativity will come into being. Therefore, protons and electrons, four hydrogen atoms, carbon-

based molecules, the four reproductive nucleotides, the DNA molecule, complementary pairs of DNA and proteins (cells), complementary pairs of cells (metazoa) and four fully developed complementary paired brains (human beings) represent steps on the evolutionary ladder leading to the next logical step, which is four complementary pairs of men and women in a new form of autopoiesis that I have called an "Ethical State."

The Ethical State produces a quantum leap in human creativity for each person individually and the four men and four women collectively, making them significantly freer of the tyranny of the random forces of the physical, biological, and psychosocial environment than has ever been achieved before. As a result, these eight persons represent a new order of sovereignty and thus comprise a new type of state in the sociopolitical sense as well. The main problem to be solved is how to practically bring about this new higher-order autopoiesis. The only objective test of our success in creating the Ethical State is that a new order of objective creativity is produced which leads to radically new scientific discoveries, inventions, and works of art that are not possible for persons who are not in an Ethical State. This test is currently being implemented.

If an Ethical State is created, then it is easy to imagine how a Moral Society can be created by voluntarily integrating many highly creative, sovereign Ethical States into a new higher-order autopoietic entity which further amplifies individual human creativity so that the Moral Society eventually has the same relationship to an individual human being that a human being has to an amoeba. The creativity of the Moral Society transcends biological limitations, as is shown in Chapter 8, and grows into ever new dimensions of creativity. In Chapter 8 we see that it is plausible for the Moral Society eventually to evolve to the point where it can integrate distinct universes and create new universes which will evolve to create more Moral Societies. This hierarchical evolution has no upper limit—it goes on forever.

The Mystical Pattern

Mysticism has many meanings to different persons. To me it means a state of mind in which we believe that in the universe there is a moral force with greater knowledge than humanity and that we as individuals can, in some way, communicate with that force. Our communication is enhanced by our ethics. This to me seems to be what all mystics have in common. This is the "mystical paradigm." This higher force may be a personal God to some, e.g., Jews and Christians, or a more abstract force to others, e.g., Buddhists and Spinozists.

However we perceive this higher moral force, it manifests itself in very similar subjective experiences, a sense of inner peace and oneness with others. Above all it manifests itself in a feeling of love longing to express

itself by enhancing the creativity of others. Unfortunately, it also manifests itself in self-delusion. Mystics include Buddha, Jesus, Spinoza, Teilhard, Einstein, and other highly creative persons who follow the evolutionary ethic. They also include Saint Paul, Mohammed, Torquemada, Calvin, Rasputin, Hitler, and other highly destructive persons with perverse ethics. Mysticism by itself therefore gives no advantage.

What mysticism seems to do is to stimulate the imagination. But as we saw in Chapters 3 and 4, the imagination is capable of generating false as well as true information. Mysticism is ethically neutral. If the mystic is ethical, his/her mysticism will make him/her more creative. If the mystic is unethical, his/her mysticism will make him/her more destructive.

Scientific method is an antidote to self-delusion within the mystical process. *The main function of science is to enable us to distinguish between imagined information that is true and imagined information that is false.* Science does not directly generate any new ideas, although it gives experimental results from experiments designed by our imagination and carried out by our ethical will. Only ethical mystics subject their mysticism to science.

My personal attitude toward mysticism, until late 1983, was that it was mainly a form of intellectual degeneracy by which persons specialized in predicting and controlling their own thoughts and thereby became immersed in self-delusion. Then in late 1983 I noticed that some objectively creative persons were also mystics. Ken Wilber, in his book *Quantum Questions* [837], showed that some of the greatest scientists of the 20th century—among them Einstein, Planck, De Broglie, Jeans, Eddington, Schroedinger, Heisenberg, and Pauli—were highly mystical. We should always pay attention to the ideas of persons who are highly creative in the objective world, no matter how strange those ideas might seem.

In my agnostic days when someone would speak to me of God or mysticism, I would ask, "What can I predict and control in the objective world by accepting your God or mystical model of reality that I cannot predict and control without it?" I never received a satisfactory answer to this question. Therefore, I regarded mysticism and the belief in God as merely one of many mental aberrations to which humanity was prone, particularly since mysticism was usually associated with organized religions. I knew of no organized religions which were not apparently destructive to the creative process. I regarded Teilhard de Chardin as someone who, as a religious practitioner and priest, overcame a serious mental handicap but was prevented from becoming more effective by his religious beliefs. All the mystical specialists I met appeared self-deluded and uncreative. Then I observed that, as a group, scientists who were guided by sincere personal mysticism (not the mysticism of organized religion) were much more creative than scientists who were antimystical atheists. They were also more humane, loving, and better at communicating their creativity to others,

which further enhanced their creativity. Therein I had the answer to my own question. *When personal mysticism or the belief in God is combined with objective science, it enhances objective creativity.* Therefore, under some circumstances mysticism is ethical.

This all seemed ironic to me, because I had originally written *The Moral Society* to be a purely scientific, albeit simplified, book, intended to appeal to and mobilize the scientific community. After it was published I realized that almost all the people who responded positively to my book were mystics, among them some scientists. But the scientific community as a whole rejected me as much as they had rejected Teilhard and Spinoza in their day.

The most support I had was from mystical psychiatrists and psychologists, who seemed unscientific to me. I therefore tried to compensate for this "embarrassment" by writing an antimystical tract called *Psychofraud and Ethical Therapy* [279] in which I debunked traditional psychiatry, psychotherapy and mysticism in general and put in their place a rigorous, austere ethical way of life, independently, but somewhat in the spirit of Jacques Monod, with whom I corresponded on these matters (see Monod's *Chance and Necessity* [531]). *Psychofraud* was even less effective than *The Moral Society.* However, I still regard it as a worthwhile guide to personal ethics and a much needed exposé of psychofraud; I am glad I wrote it and still recommend it, in spite of its errors.

In 1984 I began to look into "scientific" mysticism to see how it could be integrated into my, until then, quixotic quest for the Ethical State. I learned the following:

1. *Mystical Specialists*—i.e., mystics who are antiscientific and reject science as having any relevance to their mysticism—are as destructive and self-deluded as I had previously seen them.
2. *Mystical Scientists* are also destructive and self-deluded in proportion to how much they compartmentalize their science and their mysticism, so that they do not apply the tests of science to their mystical insights and they do not rely on their mysticism to generate new ideas in science. In general Mystical Scientists are unscientific in their mysticism and unmystical in their science.
3. *Scientific Mystics* are creative in direct proportion to how ethically they integrate mysticism and science. Those who have made a full integration between science and mysticism I call "Scientific Mystics." They are fully scientific in their mysticism and fully mystical in their science. This is the Holistic Paradigm.
4. *Scientific Specialists* are scientists who have learned one thing to almost the total exclusion of everything else and have totally rejected the Mystical Paradigm as having any relevance to their life; they usually refer to it as a superstitious, antiscientific type of thinking.

Like other narrow specialists, scientific specialists are usually minimally creative in their specialty, although they may do useful work.

5. *Artists* are creative in direct proportion to how ethical and intelligent they are. They, apparently, have no essential need of conventional scientific knowledge. Their objective artistic creations are their link to objective truth. Mysticism enhances their creativity when they are ethical and they integrate mysticism with their art, e.g., J.S. Bach, Michelangelo, Penderecki, and Dali.

At the same time that I came to these five conclusions I observed a pattern unifying science, mysticism, and art. This pattern is a repetition of the theme of ascendance through four complementary pairs. The physicist Fritjof Capra observed part of this pattern in his book *The Tao of Physics* [100]. Jung had observed another part of this pattern in the studies he did on mandalas and in his theories of the collective unconscious [395].

A mandala is a symbol of transcendence used as an aid to meditation in traditional Tibetan Buddhism and Hinduism. The symbol usually incorporates four paired (bilaterally symmetrical) components within a circle.

(Text continues on page 224.)

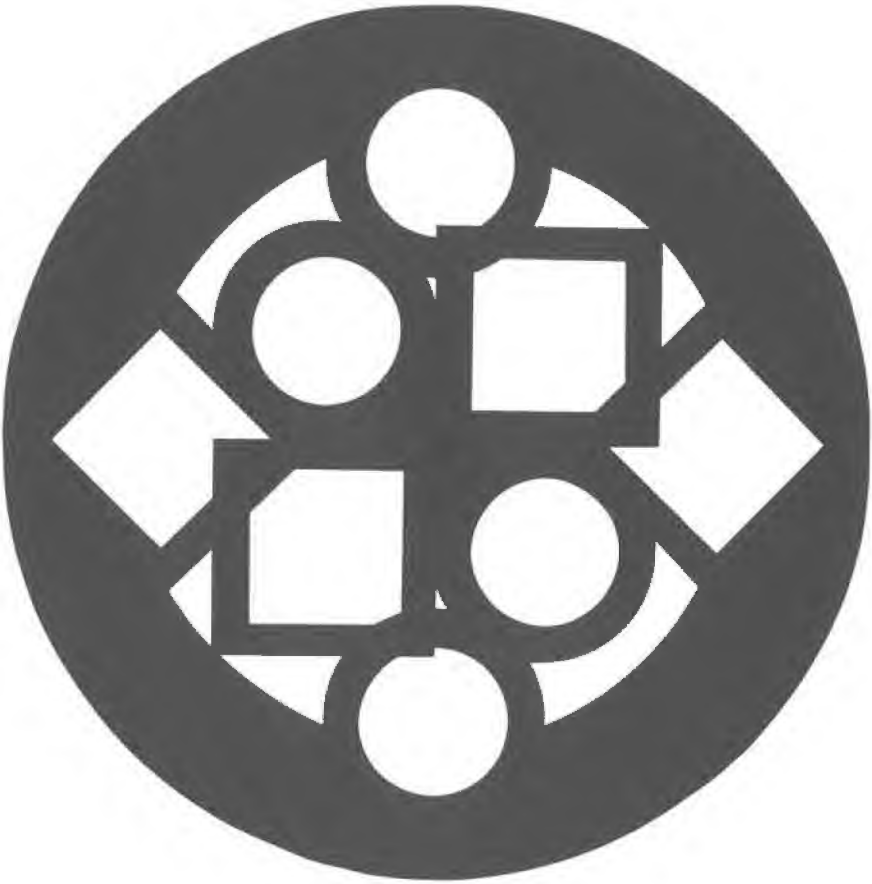
A general mandala from the work of Swiss psychologist C.G. Jung.

A Tibetan mandala, illustrating a system of four complementary pairs.

The Moral Society Mandala

A representation of a general mandala and an eight-pointed star.
(The image is the cover of the author's 1971 publication.)

A Preliminary Creative Transformation Mandala



An incomplete representation of Autopoiesis among four complementary pairs. (This figure led to the final mandala, which is shown on page 37.)

Jung had noticed that when persons achieved full individuation they would spontaneously produce a mandala. Indeed, mandalas are archetypes which occur in all cultures as a symbol of transcendence, although the concept of transcendence might be quite different in the various cultures. In Western culture it was almost always an unconscious symbol which was used for its esthetic value within a transcendental context, as in the cathedral windows or roofs. When *The Moral Society* was published, a graphic symbol was created to represent the forceful, simultaneous expansion of the eight collective components of intelligence of The Moral Society—the symbol for the generalization of intelligence and evolution. I had never heard of a mandala at the time and was not to know about them for fifteen years. Yet, inadvertently, a mandala had been created.

Within *The Moral Society* I also referred to J.S. Bach's *Art of the Fugue* as the art form that most clearly expresses the evolutionary process in completely abstract symbolism. I now know that the *Art of the Fugue* is a musical mandala based on four notes (B-A-C-H in German notation) and their complementary pairs, which Bach called "musical mirrors" (very much like the four nucleotides in DNA). Finally, when I discovered the process of Creative Transformation, I felt compelled to draw a symbol of the process, although I had never drawn anything original in my life and I consider myself to have the lowest level of plastic artistic skills of any human being. The first symbol that was produced is shown on page 223; the last one is on page 37.

Therefore, there is an independent tradition in art and mysticism which parallels the scientific pattern of evolutionary progress through quantum leaps of four complementary pairs integrated into a coherent whole. This holistic concept of evolution, science, art, and mysticism is exploding into new concepts being generated by the revolutionary "New Physics."

The New Physics

The "New Physics" is a movement begun by Einstein in the early 1900s with the special theory of relativity. Einstein's work led to quantum physics when combined with the work by Planck, Bohr, de Broglie, Heisenberg, Schroedinger, Pauli, and others in the 1920s and 1930s. Actually the basic concept of "the quantum" was first proposed by Planck in 1900 and elaborated by Einstein in his corpuscular theory of light in 1907, which explained the photoelectric effect. Fundamental quantum theory said that energy—and therefore matter—was granular and not infinitely divisible. Therefore, there was a minimum unit of energy—the quantum.

Although Einstein was a major contributor to quantum physics, he could not accept the implications of what quantum theory eventually predicted, namely (1) that nature was fundamentally random and unpredictable at its most basic levels in atomic phenomena and (2) that in nature there

was a fundamental and unavoidable interaction between the observed and the observer such that it was not possible to observe anything in nature without disturbing what we were observing. Einstein objected to the first prediction by his famous dictum "God does not play dice with the universe," and to the second prediction with "God is subtle, but not malicious." Neils Bohr is said to have responded by saying to Einstein, "Stop telling God what to do!" Remember, Einstein believed in the God of Spinoza.

Einstein insisted, in ever greater disagreement with his fellow physicists, that quantum mechanics was an incomplete description of reality. He postulated that there were hidden variables in nature. If we could discover and measure the hidden variables, then we could predict precisely and we could observe without changing what we are observing. However, the scientific paradigm and its epistemology is that truth is whatever information enables us to predict correctly, while falsehood decreases our ability to predict and leads to false predictions. (See Introduction, pages 3–4).

Even though quantum mechanics says there are limits to our ability to predict, we can predict the *averages* of all the random fluctuations at the atomic level. These averages make up the everyday world of objective reality at the macroscopic level. This is the world in which we live and experience. This is the world we directly perceive. Within this world quantum mechanics enabled us to predict chemical behavior, which is the average interaction of many billions of atoms, as well as control with lasers, superconductors, and superfluids. These last three creations are examples of macroscopic quantum phenomena. Many microelectronic devices, such as the Josephson Junction, also depend on quantum mechanical phenomena [38]. Therefore, the evidence in favor of quantum mechanics is overwhelming. In the latter part of his life Einstein's objections were merely ignored. However, in 1935, Einstein and two young associates of his used quantum mechanics and relativity to show that quantum mechanics may be self-contradictory.

The Einstein-Podolsky-Rosen Paradox

In 1935 Einstein, Podolsky, and Rosen (EPR) wrote a remarkable paper [224] which in the last twenty years has become increasingly a center of controversy. EPR showed, using the laws of quantum mechanics and relativity, that it is possible to determine the momentum or position of an electron without disturbing it if the electron is correlated with another electron. "Correlation" means that the two electrons have passed or originated close to each other and have affected one another through electromagnetic interaction, although they may in the future have moved arbitrarily far from each other. Another one of the pioneers in the new physics, David Bohm, was later able to show that the EPR paradox applies to other quan-

tum objects, such as photons and neutrons. Therefore, sometimes Bohm's name is added to the EPR paradox and it is called the EPRB paradox. In Bohm's terminology, a quantum object is any object whose mass is sufficiently small that it will be significantly affected by the quantum potential.

Quantum mechanics predicts that we cannot measure the position or momentum of a quantum object without disturbing it. EPRB predicts that if we have two quantum objects which have at some time in the past been correlated in a special way in accordance with quantum theory, e.g., by originating at a common source, and which have up to the present not been disturbed even though one might have moved to the moon and the other to Mars, we can *precisely* and *instantaneously* measure the position or momentum of the object on Mars by measuring the position or momentum of the object on the moon. The object on the moon is disturbed by the measurement, but not the object on Mars, unless relativity is violated and information is transmitted to the object on Mars much faster than the speed of light. At first, this does not seem so astounding. However, the implications are very deep.

One of the fundamental postulates of quantum mechanics is that quantum objects have a probability distribution of the states (includes positions) in which they can be. Until we observe them they are in none of those states, but potentially in all of them. This is taken to be literally true. It is *not* that the quantum object is in a particular state, and that we do not know what it is until we find out what it is: it is literally not in *any* of the states until it is observed. Very complex experiments have shown this to be true [336, 703, 836]. A bizarre consequence of this is that quantum objects can be seen either as waves or as particles depending on how we observe them, but not as both simultaneously (Bohr's principle of complementarity). For this reason some physicists, starting with mathematical genius John Von Neumann and Nobelist Eugene Wigner [836], have proposed that the nature and behavior of a quantum object are determined by human consciousness. There is no absolute separation between the observer and the object observed.

Starting in 1965 and 1966 a physicist, John Bell, showed that if the EPRB paradox turned out to be true, then the hidden variables which Einstein had been looking for were "nonlocal" [46, 336]. The concept of "locality" is that of things tied together by time and space and subject to the speed of light for interactions. When we communicate by radio waves, for example, that is a local phenomenon that propagates at the speed of light even if we are on earth communicating with a satellite near Uranus, as happened in early 1986. Nonlocal interactions can occur simultaneously over vast distances, contrary to relativity, which says information cannot be transferred at speeds higher than the speed of light. It may also be possible to have the causes occur after the effects. Nonlocality is far more bizarre than the hidden variables subject to relativistic laws that either Einstein

or his antagonists imagined. Einstein believed all interactions were local. Bohr and the Copenhagen school resolved the paradox by stating that the correlated particles would both be disturbed instantly by a measurement on one of them. This is in fact what has been shown to happen.

Starting with a series of experiments performed by Alain Aspect and his colleagues in France in 1982 [24, 703], there is now very strong, objective, experimental evidence that there are nonlocal, hidden variables at work in the EPRB, which turned out *as* EPRB predicted, but not *how* they predicted. Einstein would have been even more shocked by the notion of nonlocal, hidden variables than he was by the basic nondeterminism of quantum mechanics, although not as spiritually disturbed once he found out the implications of the nonlocal interactions of the human mind and the local universe. A better way of seeing the situation is that both Einstein and Bohr were right and both were wrong. Quantum Mechanics correctly describes the universe as an integrated whole, but there are nonlocal hidden variables tied to consciousness at work in all quantum phenomena.

One interpretation of the data—and there are other interpretations [336]—is that when one quantum object of a correlated pair is observed, what is happening is that there is an instantaneous, synchronized communication of this information to anyone who would observe the second quantum object, so that the two observations would be correlated as expected; or if there is only one observer, his one observation makes the probability state wave collapse for all correlated objects simultaneously so that all observations will remain correlated even if they are all made by the one observer at different levels. In other words the communication is not between the correlated quantum objects, which are subject to the laws of relativity, but instantaneously and nonlocally (outside of our time and space) between the observers or potential observers of the quantum objects. The exchange of quantum information mind-to-mind or between one mind and all quantum objects is not subject to relativity, the speed of light, or time-bound causality. It is a type of telepathy, but of a special kind: namely, it is unconscious when it occurs, and it works only for quantum phenomena. The hidden variables are in a special quantum space which incorporates the noöspace of our individual consciousness. Furthermore, this quantum space exists outside of the time and space of our universe, and the transfer of information can occur instantaneously within this space. When this occurs it can alter objective reality in our universe. Corollaries: (1) A single thought can have the power to change the entire physical universe; (2) language is, in part, a quantum phenomenon. Additional experimental evidence supports this interpretation of the EPRB experiments.

Beginning in the 1960s, a physicist by the name of Helmut Schmidt (not the ex-chancellor of Germany) did a series of experiments that showed that there was a direct connection between quantum phenomena and the human mind [682-684]. What Schmidt did was to create a type of clocklike

mechanism with lights which lighted up at random according to how a radioactive isotope decayed. The decay of radioactive isotopes is a random quantum phenomenon. Each light on the clock face was equally likely to light up at any instant. There was absolutely no pattern to how the clock face would light up. However, some persons, not all persons, could by concentrating on the clock face make the numbers light up in a statistically highly significant pattern, with men apparently inducing the lights to light up in a clockwise direction, and women apparently inducing the lights to light up in a counterclockwise direction. Recall that men and women are postulated to have complementary brains. This is another example of this special quantum telepathy or in this case quantum telekinesis. These persons alter objective physical reality by their mental interaction with quantum objects. There are many other indications of a direct connection between the human mind and quantum reality.

The Quantum Connection

Physicist Fred Alan Wolfe [851, 852], Amit Goswami, a professor of physics at the University of Oregon [298, 299], physicist Henry Stapp at the University of California at Berkeley [738], and others have postulated that there is a "quantum connection" between the human mind and the world of quantum reality. A more familiar notion is that of C.G. Jung, namely that we all share a common collective unconscious.

Near the end of their lives, C.G. Jung and Wolfgang Pauli co-authored a remarkable book, *The Interpretation of Nature and Psyche*, bringing together physics, psychology, and mysticism. Jung is well known to have been a mystic. It is less well known that the Nobel Prize winner Wolfgang Pauli, one of the most brilliant and mathematically rigorous physicists of the 20th century, was also a thoroughgoing mystic. In this book, published in 1951, it was predicted that by the end of the 20th century physics and psychology would become united through quantum physics. This may have been a correct prediction.

Jung saw the collective unconscious as the source of all creative knowledge. In other words, when persons were creative they merely tapped into this vast source of collective unconscious knowledge and modulated it.

In my book *Psychofraud and Ethical Therapy* I debunked Jungian psychotherapy (analytical psychology) as another form of psychofraud. I was then in my antimystical phase. However, I expressed admiration for his imagination and the appeal that analytical psychology has for objectively creative persons. Even then I believed we should always pay attention to, if not necessarily believe, what creative persons value. The belief in the creative, collective unconscious, as with the belief in God or the mystical paradigm, seems to make persons more creative. It seems that Jung hit upon a valuable and probably true concept with his notion of the collective uncon-

scious, even though his form of psychotherapy was no more valid than Freud's. On the other hand, Freud also hit on another valuable and probably true concept in his notion of the unconscious mind. It is unreasonable to expect creative persons to always be right. Creative persons, however, usually make a worthwhile contribution even when they are wrong, e.g., EPR.

Amit Goswami [299] believes that the human brain has two distinct modes of operation—a quantum mode and a classical (or Newtonian) mode. In the classical mode we learn and repeat complex patterns of behavior. The classical brain is the brain we usually associate with what we call "intelligence." The classical brain is what enables us to learn by conditioning. The quantum brain, on the other hand, is what is responsible for all our creative behavior. The quantum brain is not controllable through conditioning and is responsible for all of our "original" ideas.

Although I have major disagreements with Amit Goswami on other matters (particularly the importance he gives to conventional parapsychology, solipsism, and what seem to me mystical rituals), I am in partial agreement with his notions of the quantum connection and the division of the brain into classical and quantum modes of behavior—except that I believe this occurs in each neuron and even at the molecular level in the DNA molecule. The only important parapsychological phenomenon in which I believe is human creativity itself. Quantum telekinesis also seems to exist, but it is rarely important at the creative levels.

Evolution and human creativity are analogous processes. A benign mutation that increases the intelligence of a species by incorporating new true information into the DNA molecule is analogous to a good idea, which incorporates true new information into our extragenetic information pool. A deleterious mutation that decreases the intelligence of a species by incorporating new false information into the DNA molecule is analogous to a bad idea, which incorporates false new information into our extragenetic information pool. A satisfactory model of the quantum connection must unify the evolutionary and the creative processes. Evolution is a creative process. There was evolution before there was a brain; therefore, there was a quantum connection before there was a brain.

We know that evolution is an accelerating process in which benign mutations are occurring at ever accelerating rates. Single-celled organisms ruled the earth for three billion years before simple multicellular animals with nervous systems appeared (e.g., the hydrae). As the nervous system developed, the rate of evolution went faster and faster and the human brain doubled in size in less than two million years. In the brain there is far more complexity (number of components multiplied by number of connections between components) than there is in the rest of the entire body. The doubling of the hominid brain in less than two million years represents the greatest quantum leap in complexity in the history of biological evolution.

The evolutionary school of punctuated equilibrium, associated with Stephen Jay Gould, has gathered considerable evidence that neither Darwinism nor neo-Darwinism is in accordance with the evolutionary fossil evidence indicating that new species often arise all of a sudden by radical quantum leaps, and not by gradual changes that slowly consolidate themselves by natural selection. Yet recent evidence indicates that one of the main examples used by Gould, the panda's thumb, was possibly not a quantum leap in evolution, but represented a slow change over tens of millions of years. Gould has, with his usual eloquence, expressed the notion of punctuated equilibrium by his statement, "The first bird hatched out of a reptile's egg" [300].

To turn a reptile (actually, a small dinosaur) into a bird in one fell swoop involves so many genetic changes that they could not occur by random mutations in one generation. The probability of this occurring is so low that it would almost certainly not happen even in five or ten billion years. And there are thousands of apparent quantum leaps in evolution. Therefore, there must be another feedback mechanism to the evolutionary process in addition to natural selection. This additional feedback mechanism, I postulate, is the quantum connection.

I still believe that natural selection is a part of the evolutionary process. However, it is only part of the process, not all of it. Another part is the quantum connection. There may be still other parts. Darwin, like all great scientists before him and after him, was only partially correct.

Sir Fred Hoyle is an ornament of our civilization. As a great scientist and artist, he plays the crucial role of repeatedly challenging the conventional, well-established wisdom of the scientific community when it is beginning to be smugly taken as axiomatic. He did this when he developed the steady-state model with Bondi and Gold [771] in the late 1940s. This was as valuable a contribution to scientific thought as were Einstein's challenges to quantum theory that culminated in the EPRB paradox. It is always unethical to be certain about cause-and-effect relationships.

Starting in the early 1970s, Hoyle and his associate, Chandra Wickramasinghe [363, 364], have begun to challenge the conventional wisdom of Darwinism and neo-Darwinism. Hoyle claims that the probability of having evolved the particular combination of enzymes which makes human life possible is less than 1 in $10^{40,000}$. This is a number so huge (1 with 40,000 zeros after it) that there is almost no chance that this combination could have occurred by chance and been selected in five billion (5×10^9) years [360, 771]. He has also shown many holes and contradictions in the conventional evolutionary record. There must be another feedback mechanism in addition to natural selection. Fred Hoyle has come up with a mechanism just as radical as the quantum connection [360].

Hoyle's astronomical analysis of the interstellar clouds of particulate matter have convinced him that these clouds are made in part of bacteria

and viruses. Furthermore, he has mounted a theoretically brilliant, experimentally falsifiable argument since the early 1970s to show that the quantum leaps in evolution are caused by the infections of our animal bodies by bacteria and viruses from outer space. It is possible to have viruses introduce genes into human cells. His conclusion is that evolution is intelligently directed by a superbeing (a god in the Greek sense, not God in the Judaeo-Christian sense). This god seeds the universe with genes to enable life forms to evolve throughout the universe.

At the same time Hoyle recognizes that the human brain is a quantum mechanism that could theoretically be affected by information from the future. This quantum information is responsible for our moral sense and our creativity. He implicitly recognizes the quantum connection. The god that sends information from the future is more like God in the Judaeo-Christian sense. There may therefore be a hierarchy of gods all driven by the same ethic—to maximize creativity—although if your belief in God is derived from Judaism, you might call the lower gods "angels" or even "saints." As might be expected, the scientific establishment has almost universally rejected Fred Hoyle's ideas on evolution.

As much as I respect Fred Hoyle and value all of his creative contributions, particularly his brilliant challenges to the scientific establishment, I find it hard to accept his bacterial and viral mechanisms for evolution. This would imply that god was not particularly subtle and quite malicious in giving us a potentially fatal infection in order to produce a benign mutation. If such a god existed he would be a clumsy apprentice-god working at the galactic, but probably not at the universal, level. This god would help the evolutionary process get started on lifeless worlds and contribute to the re-seeding of new bacteria and viruses as the environment changed. (Fred Hoyle gives an excellent argument that chlorophyll did not evolve on earth.) The major mechanisms for evolution would still be natural selection and the quantum connection.

The quantum connection brings an elegant unity of design, worthy of God, to the entire universe. The most recent cosmology which has united with particle physics and quantum mechanics implies a quantum connection from the instant of creation, when the universe was created through a single quantum event in an infinite sea of entropy. From 10^{-43} seconds after the start of the universe almost the entire gross evolution of the universe is predictable, on the average, by quantum mechanics and relativity. The new physics [328, 689] and some forms of mysticism further imply a quantum-connection mechanism at work in all facets of evolution from the beginning of the universe to current, individual acts of creativity. David Bohm's model of the implicate order [62, 63] explains the information-rich universe and evolution in terms of quantum mechanics as an unfolding of infinite truth outside of our time and space. God is a creative process. The fine-tuning of the universal constants—such that if some varied by as little

as one part in 10^{30}, the universe as we know it would not be possible and neither would evolution—indicates a quantum intelligence at work using the quantum connection to influence our evolution. For this and other reasons, and as much as it will alienate me from the scientific community, which I respect, I subscribe now to the quantum connection and I believe in God as the creator of the universe.

God

As Fred Hoyle has pointed out, the scientific community is loath to allow the concept of God into scientific discussion, and with good reasons. I gave a reason for this at the very beginning of the book. Galileo's experience is an even better reason why theologians should stay out of science. However, when the evidence of intelligence at work becomes overwhelming, it is unscientific to deny that it is there. The scientific community is absolutely biased in favor of purposeless, blind forces at work. That is why Darwinism is so comfortable to the scientific community.

The creationists in the United States have exacerbated the problem by denying the empirical evidence for the facts of evolution. They have tried, by political machinations, to impose on the public school system a completely unscientific theory whose only virtue is that it supports their religious biases, which are narrowly sectarian and disagree with the views of most Christians. This has made the scientists even more entrenched in their antitheistic bias. However, the creationists, including those with scientific credentials, should be seen compassionately as frightened, ignorant persons who see Darwinism as a threat to their quantum connection. Darwinism by itself can easily be corrupted to justify destructive systems such as Nazism, communism, and predatory capitalism. Pure Darwinism obviates the requirement for any moral order to the universe. Just as Marx lived long enough to deny being a Marxist, Darwin, a minister's son, might deny being a Darwinist if he lived today. Religious fundamentalists usually have little in common with the founders of their religion, who were usually more open-minded and creative. What would Jesus think of the fear-filled, allegedly Christian fundamentalists of today, who constantly violate Jesus' sole commandment that we love one another?

As we evolve toward a Moral Society, it is easy to imagine that we will be ever more effective in increasing creativity throughout the universe. That is our ethical imperative. If we should evolve to the point where we have complete understanding of our local universe, the next creative challenge in harmony with the evolutionary ethic would be to design and create nonlocal universes, outside of our time and space. If that is where we are going, it is reasonable to assume that that is whence we came.

In order to evolve forever, a Moral Society must create ever higher dimensions for its creativity. It is reasonable, therefore, to imagine that our

own local universe was created by a Moral Society that wanted to improve that universe in which it evolved in order to create ever more Moral Societies that would create ever better universes in ever higher dimensions.

A Moral Society, no matter how evolved, is always a finite being. It is a god to us in the same sense that a human being is a god to an amoeba. Therefore, a Moral Society, no matter how evolved, is a god in the Greek sense, not God in the Judaeo-Christian sense. Furthermore, there is no *greatest* Moral Society, no more than there is a greatest number. Only the process is infinite. Therefore, God in the Judaeo-Christian sense is not a person or a single being, but a process. That is why God cannot be represented by visual imagery. That is why Franklin, Jefferson, Goethe, Einstein, and many others believed in the impersonal God of Spinoza. Only processes can be infinite, never persons.

God is the infinite process, within the infinite universe of all universes, by which creativity is forever expanded. God exists in the quantum timeless universe of infinite information produced by the set of all Moral Societies that have ever existed and ever will exist. Everything that exists is created by a Moral Society and is part of a Moral Society, as was foreseen by Spinoza. Everything that exists is a modification in the infinite process that is God. God creates us as we create God by expanding forever the creativity of the universe. The ever expanding creativity of the universe is the glory of God. We worship God by doing our best to learn, teach, and create. As Teilhard said, "The worship of a modern person is through research and development." As Spinoza said, "To love God is to do our best to understand and emulate God." We create God as God creates us. This concept is called "autopoiesis."

Autopoiesis: Overview

Autopoiesis means "self-creation." *Poiesis* is from a Greek word meaning "to make or create" (it is the root word in "poetry"). The term *autopoiesis* was coined by Varela and Maturana [796] to express the tangled hierarchical process by which life arises as an epiphenomenon of protein creating DNA as DNA creates protein. It also applies to the tangled hierarchical process by which the brain modifies the mind as the mind modifies the brain to produce the epiphenomenon of human consciousness. The autopoietic interactions of our four complementary brains create the epiphenomena of ethics and creativity. The fundamental autopoietic interaction is the tangled hierarchical process by which God creates everything as everything creates God, thereby producing the epiphenomenon of evolution. It is a holographic process by which each part reflects the whole [62, 63, 838]. Therefore, the challenge before us is how human beings can create a new, higher order of autopoietic interactions within a group of four complementary pairs of men and women to create a new level of consciousness we call

"The Ethical State," to produce the epiphenomenon of morality—leading to the creation of creativity. But before discussing the Ethical State we shall speculate on how autopoietic interaction through the quantum connection enhances the evolutionary process and produces the quantum leaps in evolution. This in turn shall help us understand how to bring about autopoiesis at the super-metazoan level between four men and four women.

The Quantum Mechanics of Choice

Quantum mechanical phenomena occur because there is a possibility of choice *which is not predetermined.* There are two types of choices: (1) Whether we are going to observe the quantum entity as a wave or as a particle, and (2) whether we focus on momentum or position for a particle, or on energy or time for a wave. The uncertainty principle says there is an irreducible error determined by Planck's constant in the simultaneous prediction of these factors. These types of errors in one dimension are as follows:

Equation 5.1 $$(\Delta X)(\Delta P) \geq \frac{h}{4\pi}$$

where: ΔX = position measured to its smallest variation due to error, i.e., error in the position of the particle.

ΔP = momentum measured to its smallest variation due to error, i.e., error in the momentum of the particle.

h = Planck's constant = 6.62565×10^{-34} joule-second

$\frac{h}{4\pi}$ = 5.2×10^{-35} joule-second, *or*

Equation 5.2 $$(\Delta E)(\Delta T) \geq \frac{h}{4\pi}$$

where: ΔE = energy measured to its smallest variation due to error, i.e., error in the energy of the wave.

ΔT = time measured to its smallest variation due to error, i.e., error in the time at which the energy is determined.

h = as above

Therefore, depending on what we choose to observe we determine the error in position, momentum, time, or energy as the case may be. As EPRB, Helmut Schmidt, and other recent experiments have implied, and as John Von Neumann and Eugene Wigner first proposed, it is not the observation *per se*, but our choice or consciousness of the situation which to a degree (not entirely) determines objective reality at the quantum level.

There follows what all this means to me. It is how I choose to interpret reality. There are many other interpretations [336]. Other interpreta-

tions may be as good or better. Ultimately, I will accept the interpretation (even if it means rejecting everything that seems true to me now) which will maximize my objective creativity and that of those with whom I interact. The maximization of objective creativity is the only goal. That is the only irreversible choice I have made.

Many choices have irreversible consequences. Suicide and murder are obvious examples. There are other less obvious irreversible choices. Among these are values we choose to emphasize in life. For reasons given elsewhere [279, 280], a choice of the value of happiness over the values of truth or creativity leads to an irreversible process of ethical decay, even though we may not be consciously aware of having made that choice. Furthermore, there is evidence that a human choice may be triggered by a single quantum event at a single neuron in the brain [738], so that ultimately our choices themselves are not predetermined, but neither are they totally random. If choices were totally random then there would be no possibility of progress because there is a much higher probability that a totally random (maximum entropy) choice, i.e., a choice in which all possible outcomes are equally likely, would be destructive and not creative. Merely think of alternative actions that are destructive and those that are creative in any given situation. It is always easier to destroy than to create. Therefore, there is a process in nature which derandomizes choices and leads to progress. We call this process "evolution" or "God" as the case may be. Ultimately they mean the same thing.

Both my intuition and my reason tell me that our local universe was created by a super-metazoan ethical intelligence that as a minimum had the same kind of relationship to a human society that a human society has to single cells. This Moral Society, however, was a finite being; it was capable of making errors. That is why our local finite universe is not perfect; i.e., evolution leads to many mistakes which are corrected by natural selection, and our imagination produces many false ideas. The Moral Society had to give up complete control of its creation and allow free will to operate in order to create a moral society greater than itself.

As a Moral Society driven by the evolutionary ethic, our Local Moral Society (LMS) (it is locally connected to our universe) tried to create a universe that would maximize creativity. As a highly evolved being aware of God it would not presume to know everything but would try to maximize the quantum connection between our local universe and God so that our local universe would produce the maximum number of the most creative Moral Societies, which would eventually unite with one another and the Moral Society which created them (Teilhard's "Point Omega"). This is local autopoiesis. Nonlocal autopoiesis involves any entity uniting with God—that is, the evolutionary force—by *making a choice* to become closer to God. This choice does not necessarily require consciousness as we understand it. It requires merely that the entity make a choice to move

in the direction of greater generalized intelligence. Remember that creativity is the highest and the most generalized form of intelligence known to humanity.

If we wish to maximize the creativity of our children we must eventually give them *complete* freedom, or we will stifle their creative growth. When they are very young we intervene and limit their freedom because if we do not they may seriously hurt themselves or others; but eventually we must set free those we love and give them the opportunity to be destructive, or we will destroy their chance of becoming creative beings. We must do this even if we believe we know what is best for them and we are virtually certain that they are making the wrong choices. For choice to be meaningful, it must be ours and not someone else's. A corollary is that a benevolent tyranny is unethical. Therefore, all tyranny is unethical, including democracy.

It is not always clear at what point it is best to give our children complete freedom. Legally our society emancipates children from their parents somewhere between the ages of 18 and 21. Some parents try to emancipate their children almost from birth by essentially becoming their servants and not interfering with the child's wishes if at all possible. These children are usually difficult to be around. However, I have found that they eventually get negative feedback from their peers, and they do not seem to turn out worse than other children.

LMS is both our mother and father. (Remember, LMS = Local Moral Society that created our local universe.) It created a universe to create us and help us evolve into a better Moral Society. However, it did not predetermine this. It gave us an ever increasing degree of free choice to determine our own destinies. From the first cell, we have always had the choice to evolve or not evolve—except until now it was not always a conscious choice.

Every species chooses its own evolution. It does this by choosing how to behave. All of life plays the Game of Life. Its behavior in turn determines its evolution. I hypothesize that there is a quantum connection built into every neuron and into the DNA molecule itself when it interacts autopoietically with protein.

Every living creature makes a choice to open its quantum connection and evolve when it chooses innovative behavior which increases its generalized intelligence. Every living creature makes a choice to close its quantum connection and not evolve when it engages in repetitive behavior and it chooses not to innovate.

We can now see how quantum mechanics brings this about.

The quantum connection in our local universe is determined by Planck's constant (h). It is our opening to a universe of infinite information that is both everywhere and beyond time, matter, and space (Bohm's implicate order). It is our connection to God. LMS in creating our universe had to adjust all the universal constants to fit just right with the value of

Planck's constant that it chose. The value of Planck's constant determines the unpredictability of our universe by even LMS. If Planck's constant is too large, the whole process becomes chaotic; if it is too small there is not enough uncertainty for us to become creative. (Newton implicitly assumed Planck's constant to be zero; he explicitly assumed the speed of light to be infinite.) The creation of our universe was somewhat like throwing a very large number of dice to choose a numbered formula for development. LMS has designed the dice as well as the formulae and knows what numbers are possible on each die. LMS can also determine where they will all fall, but LMS cannot determine the precise number that all the die faces will sum to. This number determines the evolutionary possibilities for each star. LMS may have constrained the number, but it left many possibilities open. So long as Planck's constant is not zero there are infinitely many possibilities. LMS might have hoped that most of the possibilities were good ones and that in its design it had minimized the possibility of a destructive universe; but if LMS did not leave an open quantum connection, making it possible for entropy to grow, it would have destroyed the creative potential of its own creation. Without free will, the Moral Societies evolving in our universe could not possibly have been better than an exact copy of the original LMS. That is not progress. All ethical parents want their children to be superior to themselves. Free will is essential to creativity, and free will comes not from ourselves but from our connection to God. LMS compensated for its potential errors by creating a cosmic quarantine so that errors at one star would be constrained and not propagate among the stars. This is elaborated later.

Beginning with the first cells there was the possibility, although a very low probability, of innovative behavior. The DNA molecule was subject to mutations by both the external environment and the internal environment. The latter enabled a single, internally generated quantum event in the DNA of the cell to trigger a cascade effect of events among the coherent quantum components of the cell, leading to both innovative behavior and a restructuring of the genetic code. Those cells that specialized by repeating the same behavior over and over again, the vast majority, would become evolutionary deadends. Those cells that innovated behavior which increased their generalized intelligence had a corresponding genetic change in their DNA. Remember that, in cells, behavior is determined by the DNA. Furthermore, quantum mechanical events, such as tunneling (see Glossary), can make subtle alterations in the structure of the DNA, which both changes behavior and becomes part of the permanent record. The essential concept is the duality of a single mechanism that both causes behavior and stores genetic information.

Single cells are not known for their innovative behavior. Therefore, the evolutionary feedback that comes from the quantum connection is at first not much more efficient than that hypothesized for random mutations

and evolution by natural selection. That is why it took single cells three billion years to evolve into the metazoa.

Prior to the first cells, evolution had been primarily, but not entirely, a deterministic process preprogrammed into our local universe by LMS. Each star system is a unique, partially random experiment in evolution. There is always the uncertainty due to Planck's constant. Therefore, LMS created deterministic, evolutionary structures that took the process up through chemical evolution to DNA and proteins. This process begins with a highly uncertain situation determined by Planck's constant and the other physical laws at the time of the Big Bang. Then macrostructures made of noncoherent quantum objects begin to grow which become ever more deterministic and as a consequence less innovative; but together these macrostructures eventually become possessed of a feedback system and a trigger mechanism made of coherent quantum objects that can alter the entire macrostructure by a single quantum event. We call this last macrostructure a DNA molecule in autopoiesis with protein, or a living cell. Therefore, I suspect that the DNA molecule evolves deterministically from simple molecules very rapidly under the conditions of the primitive earth in accordance with Manfred Eigen's theories [217-219] of chemical evolution, and then becomes less subject to chemical determinism as the new, higher-order quantum connection is created. A corollary is that life everywhere in the universe is probably based on DNA and protein. I do not believe that life evolves on nonearthlike planets. However, I believe that almost every star eventually has an ecosphere for an earthlike planet during part of its life cycle. We are, after all, created in the image of God.

Part of the evolutionary process is therefore to create an ever expanding hierarchy of quantum connections so that ever more complex behavior can be controlled and consolidated by quantum events and choice. This begins with the autopoietic interaction of DNA and protein. The single cells are still highly subject to chemical determinism, but they have a small quantum connection that enables the cell to choose innovative behavior over repetitive behavior through the occurrence of simple quantum events within the DNA molecule itself. The next dimensional quadrature of the quantum connection occurs with the metazoa; this is a dimensional quadrature of autopoiesis producing coherent cells. However, it is the formation of the nervous system, consisting of coherent neurons, which starts shortly after the evolution of multicellular creatures without a nervous system (such as Volvox and the sponges), that gives evolution its major impetus. This is why animals evolve much faster than plants. The first creatures with nervous systems were similar to the hydrae.

I hypothesize that there is a hierarchical chemical feedback system between corresponding hierarchies in the nervous system and the genetic DNA such that repetitive behavior induces mutations leading to further specialization of intelligence, until there is no more innovation and the

quantum connection is almost closed for a specialized species with irreversible entropy. That is why specialized species never go back to being generalized. The choice to specialize is irreversible.

Innovative behavior, on the other hand, leads either (1) to extinction or (2) to mutations conducive to a continued increase in generalized intelligence, or if they are trivial, (3) to "genetic drift," which are mutations that neither help nor harm the organism initially, but contribute to its genetic variability and eventual evolutionary potential. Remember that trivia is a set of measure zero. The chemical feedback can be through hormones or, more likely, memorial RNA-like molecules, which can work backward and alter DNA [280]. This, not the bombardment of the biosphere by genes from outer space, is probably what produces most cases of punctuated equilibrium in evolution—although both phenomena may occur.

As the nervous system evolves it becomes increasingly effective both at innovative behavior for generalized species and for converting the quantum chemical events that produced this behavior into genetic changes. This explains why evolution went so slowly for three billion years—when there were only single cells without nervous systems—and why the rate of evolution has been increasing ever faster during the last billion years since the beginning of multicellular animals with ever evolving nervous systems. Each improvement in the nervous system increases the rate of evolution. Thus, cells evolve very slowly. Metazoa and plants without nervous systems are new autopoietic lenses that evolve more rapidly. Creatures with simple nerve nets, up to the appearance of the first brains, evolve much more rapidly. Creatures with true brains—fish have the highest form of a true primitive brain—evolve more rapidly than mollusks and other invertebrates that have simpler brains. Reptiles have a new brain (the R-complex) after the fish brain, and evolve more rapidly than fish. Mammals have a new brain (the mammalian cortex) after the reptile brain, and evolve more rapidly than reptiles. Finally, hominids (with a generalized neocortex and four coherent autopoietic paired brains) evolve more rapidly than all other mammals. Further, this new evolution is centered almost entirely on brain changes.

We have over 98% of our genes in common with chimpanzees! Thus, relatively few genes are responsible for our differential complexity, which may depend more on our chosen quantum connection than on our genes. Our true differential complexity comes primarily from the quantum field and the infinite implicate order. Each of the four brains leading to *Homo sapiens* represents a dimensional quadrature over the previous neural structure. The fish brain was a dimensional quadrature over the nerve net with ganglia. The reptilian brain was a dimensional quadrature over the fish brain. The mammalian brain was a dimensional quadrature over the reptilian. The hominid brain was a dimensional quadrature over the brain of all other mammals because hominids developed the most generalized neocortex, which completed the next four complementary pairs in the evolutionary hierarchy.

At each point of dimensional quadrature, there is the choice of specializing or not specializing. Remember, trivial innovations produce genetic drift. When the primates had the most advanced mammalian brains, other mammals with almost equally advanced brains chose to go back to the sea and specialize. These became the cetaceans, the whales and dolphins, who now have brains almost as complex as humans' but much more specialized. Similarly, those primates who innovated the behavior of walking upright while simultaneously using tools punctuated their equilibrium by mutating into the hominids. The hominids who innovated behavior by inventing new tools, social organization, and language repeatedly modified the genes that determine brain structure, as well as their quantum connection, and evolved into modern *Homo sapiens*. By contrast those that became stuck in a rut of repetitive, conservative behavior patterns specialized their brains, closed their quantum connection, and became extinct. Neanderthal was the last to do this. Paranthropus *(Australopithecus robustus)* was one of the first. Some highly ritualized human societies are still trying to turn off their collective quantum connection; they pay for it by being uncreative. Since the advent of *Homo sapiens* human evolution has been determined primarily by subtle changes in the brain which predispose the species to innovative or repetitive behavior.

This is not a new form of Lamarckianism which predicts the inheritance of acquired characteristics. Gross changes in the body, such as cutting off the tail of each succeeding generation of rats, or indeed inducing any body changes other than in the germ plasm, would not be inherited. In order for the behavior to induce a genetic change, it must be freely chosen by the organism through its quantum connection. Each organism is continuously presented with situations in which either it can repeat a type of behavior which is instinctive or was found beneficial in a similar situation in the past, or it can try something new. If it innovates and survives, it predisposes itself to a genetic mutation which will make that behavior more likely in the next generation and automatically increases the generalized intelligence or the genetic drift of the species. If it repeats the successful behavior of the past, it predisposes a mutation which will even further reinforce that behavior, close its quantum connection, and make its progeny still more specialized. A species has reached irreversible entropy when it can no longer innovate behavior. All species lose their ability to innovate behavior as they specialize because of the choices of their ancestors. Every 26 million years many of the specialized species become extinct as the cosmic force prunes the Tree of Life of its dying branches. A corollary is that psychological conditioning as an educational tool is destructive to creativity. Education, if it is to maximize creativity and not merely increase intelligence, must have no extrinsic rewards or punishments associated with it. Similarly, if a tyranny takes away the right to choose, it destroys ethics and creativity. (See Chapter 6 for further discussion of these subjects).

This hypothesis about evolution can be tested experimentally. It is falsifiable. The problem in testing it is time. Since most species are specialized, they rarely innovate. Some human beings innovate rapidly, but they all breed very slowly, and they tend not to mate on the basis of their innovative abilities. Still I would expect for all species that when both parents are innovative in their behavior, their descendants will tend to be more innovative than their parents in a manner not explained by current genetic theory, which predicts a regression to the behavioral mean of the breeding group. Therefore, experiments should be multigenerational among humans and highly generalized mammals such as opossums and chimpanzees.

Chimpanzees are highly innovative in their behavior but have not had a chance to develop their quantum connection since they became knuckle-walkers because of competition from hominids who have preempted the ecological niche of an innovative, machine-building primate. In protected, creative environments where chimpanzees were allowed to freely breed selectively on the basis of their innovative behavior, we should see a much more rapid increase in innovative behavior and generalized intelligence than would be predicted by conventional genetic theory. Indeed, I would predict that, among chimpanzees, generalized—not specialized—intelligence would increase more rapidly if they were freely bred for desirable innovative behavior than if they were classically bred for intelligence itself. In other words, when both mates are innovative, evolution is enhanced.

For those who find chimpanzees too slow in breeding and expensive as laboratory animals I would recommend using as a laboratory animal an opossum, which is a notoriously stupid, noninnovative animal but highly generalized and a rapid breeder. Rats and mice may already be too specialized to significantly innovate behavior. If not they would be the ideal laboratory animals for this experiment.

Given this theory, it might at first be expected that there would be enormous evolutionary pressure to select for innovative behavior. However, that would be true only if all innovative behavior were creative. There is a small set of behavior that is trivial. Remember, "trivia" is a set of *measure zero*. There is the much larger, non-zero measure, set of behavior that is destructive innovative behavior, which can manifest itself as insanity in all species. Indeed, the more innovative the species, the more prone it is to insanity. This is where natural selection comes into play.

Destructive innovations are quickly eliminated by natural selection. Furthermore, for pre-ethical species where $E = 0$ (recall Equation 3.1 on page 125), destructive innovations are just as likely as creative innovations. However, innovation is still a much better bet than totally random mutation, which almost always produces deleterious changes. No one has ever observed a random beneficial mutation, much less a quantum leap in evolution by totally random mechanisms. There is even less experimental evidence for this dogmatic feature in Darwinism than for the quantum

theory of evolution. Furthermore, it cannot be experimentally verified, because no one will ever see a random beneficial mutation. The latter are an article of faith to the classical Darwinists. Any significant innovation in behavior by a member of any species should produce a change in its genome which may be chemically detectable. We note that species such as insects and bacteria, which rapidly adapt to insecticides and antibiotics respectively, do so because of the natural genetic variability that already exists among them due to genetic drift. They do not produce new genetic mutations in response to these chemicals.

A fifty-fifty chance is an excellent evolutionary bargain. We have no choice over the completely random mutations, such as those induced by cosmic rays, caffeine, sudden temperature rises, and other vagaries of the environment. Almost all of those are deleterious. Random beneficial mutations are a set of measure zero! However, we have a choice over innovative behavior.

How many persons would take the choice of innovative behavior over a tried-and-true method if the probability of the innovative behavior leaving us worse off were fifty percent? Probably very few. That is why evolution is such a slow process and why almost all species choose to specialize whenever possible. That is why the evolution of *Homo sapiens* has been so rapid. Other species choose, but do not know they choose. We choose and know we choose. That's what it means to be an ethical species with a moral sense. If we are ethical, the odds are in our favor, and we have an ethical obligation to take a risk and innovate.

Finally, this innovative theory of evolution explains why some species with a stable niche, such as the horseshoe crab, can remain genetically stable for hundreds of millions of years, even after they have become highly specialized. Since they no longer innovate, they no longer evolve. Because their niche is highly stable they are skipped by the cosmic pruning every 26 million years. They have found a secure niche in which to hide, but they are still doomed to eventual extinction, because only those who innovate can continue to evolve forever.

Ethics and Choice

Ethics is a preprogrammed desire for truth built into the neocortex. When we make an ethical choice we choose what we believe will maximize truth or creativity. All species with a neocortex seem to have a modicum of ethics, although it is much less developed in other species than in our own. Species that innovate cultural, as opposed to genetically determined, behavior clearly have some ethical capacity. Chimpanzees in the wild have been seen to innovate simple tools and to innovate behavior, both destructive and creative. Cetaceans and elephants all seem to have some linguistic ability. Dolphins are solicitous of the welfare of other warm-blooded species, particularly humans. There are many reports of persons saved from

drowning by dolphins. This is also indicative of ethics. Dolphins are also excellent at innovating behavior.

The macaque monkeys in Japan, who allegedly innovated food-processing behavior and taught it to others, might have had a modicum of ethics. The hundredth-monkey syndrome [699] reported among them—indicating that as soon as about 100 monkeys on one island had learned this innovation, monkeys on other islands began inventing it on their own—could be a quantum effect of a critical mass of innovative behavior triggering similar innovations through their quantum connections with the other monkeys on the other islands. It might also mean, contrary to the popular reports, that the original reports were lies or that knowledgeable monkeys could swim or otherwise get to the other islands. The original reporter of the hundredth-monkey syndrome claims he only intended his statement to serve as a metaphor, not as literal truth.

I suspect that the theory of morphogenetic fields of Sheldrake [699] is valid only insofar as it corresponds with the quantum theory of innovative behavior. Morphogenetic fields are nonlocal perturbations in the universal quantum field produced by the choice to innovate. The choice to innovate, like the evolutionary process itself, is self-catalyzing. A new species starts when a small interbreeding group engages in the same highly innovative behavior, such as clumsy, rudimentary flying for the small dinosaurs of 200 million years ago and long-term upright walking and tool-using by the hominids of five million years ago. The more members of a given species innovating the same behavior, the easier it becomes for other members of the species to innovate the same behavior. A morphogenetic field is, therefore, an unfolding of the implicate order within the universal quantum field [63] by the collective, common, innovative choices of members of a given species. Sheldrake merely assumed the existence of morphogenetic fields without explaining the mechanisms that caused them.

In spite of the evidence of ethics in other species, I suspect that ours is the first that has depended on ethics for survival. This is in opposition to classical Darwinian theory, which says that ethical—and certainly altruistic—behavior is nonadaptive since it usually gives no reproductive advantage to the ones behaving ethically, and never does so to the ones behaving altruistically. Indeed, it may have been a series of ethical choices that first punctuated the equilibrium of our prehominid ancestors and then led to upright walking as the major anatomical mutation below the neck in the last 20 million years. I suspect that the common ancestor of all the hominoidea—gibbons, orangutans, gorillas, chimpanzees, humans—was a tree dweller that innovated ground-dwelling behavior. It had a greater propensity to walk upright than all its descendants except for hominids. This was a species probably ancestral to Ramapithecus and Sivapithecus.

Because it was an ethically driven species without culture, it was at a short-term biological disadvantage and left few progeny and fossils. As

different members of this ancient species would revert to walking on all fours, they specialized, mutated into new species, and gained short-term biological advantage but lost some of their ethics and gave rise to the gibbons and the knuckle walkers. Knuckle-walking is almost as strange as upright walking. It might result from a partially upright walker reverting to all fours. Finally about five million years ago the first hominid became an irreversible upright walker that could no longer effectively go back to walking on all fours. He had to continuously create to survive. This was the second punctuation in our direct ancestors' equilibrium.

Ethical choices are like generalizations; they give long-term genetic advantage to the interbreeding group at the cost of short-term risk and disadvantage to the innovator. That is why, even among mammals with neocortexes, ethics are rare and specialization is common. If every time we make an ethical choice we increase the creativity of our future children, or of other persons who are genetically close to us, there is an advantage to ethical behavior not obvious to simple Darwinism. Note that all human beings have over 99.9% of their genes in common. Because of the ways gametes are produced, the advantage of an ethical choice might be primarily patrilineal and would explain some of the ethical differences between men and women—namely, why men seem much more willing to take ethical risks than women, while women seem much more open to low-risk mysticism, and new ideas in general, than men. Therefore, ethical behavior might be adaptive even to species devoid of culture who are highly innovative and relatively intelligent, as the early hominoidea must have been. It takes a minimum level of intelligence to produce enough creativity to compensate for the dangers of behaving ethically (C = IE). The early hominoidea might have had this minimum level of intelligence.

Cultural evolution started when ethical behavior had clear value to group survival, since the ethical values are passed on in the cultural tradition. That is why Socrates' dying for his principles still influences us today. Jesus, dying for his, influences us even more, although he apparently left no progeny. Christianity helped create Western Civilization. Today ethical choices are clearly essential to our survival as a species. Yet many adult humans seem to disregard their ethical nature and live only to increase their happiness. The reason for this is fear.

Fear

Fear is the belief we cannot create. Fear has been hard-wired into the reptilian complex for over 250 million years as a mode of survival. For hundreds of millions of years our ancestors saw at least half of all innovative behavior lead to disaster. Among humans more than half of all the "popular," innovative behavior leads to disaster, since unethical innovations derived from deception and self-deception are more likely to promise happiness to

persons than ethical innovations. Ethical adults seem to be a distinct minority in our species. Ethical innovations are seen by their creators as ends in themselves and are not sold as a means to make persons happy. Unethical innovations, such as popular ideologies and psychofraud, are always sold as means of helping persons become happier in either this world or a future world. The future "world" itself may be a "natural" communist utopia or a supernatural Muslim or Christian heaven. Therefore, over half of all human behavioral innovations seem to be disastrous. These deleterious mutations almost always represent a corruption, derived from fear, of a more ethical, earlier innovation, e.g., Jesus and St. Paul, Judaism and Mohammed, Spinoza and Jefferson, Karl Marx and Lenin.

Compounding this state of affairs is the sad fact that our whole society is structured to convince persons through reward and punishment conditioning that they are not creative. Instead they must do as they are told, learn what is taught, regurgitate it as it was taught, not innovate, and then they will be rewarded and not punished. Persons are constantly rewarded for repetitive, ritualistic behavior and punished for any innovation which violates popular prejudice. Popular prejudice is almost always destructive. It leads to unethical adults. Children are born ethical. That is why the young are almost always less conservative and more creative than their elders.

Many persons are convinced that we live in a world of scarce resources and that the best they can do is, if they are weak, share in the resources equally, or, if they are strong, take them away from others for their own benefit. The former view produces predatory socialism. The latter view produces predatory capitalism.

To create is to produce more than we consume. This is something almost no one realizes he/she can do. Yet it is the basis of all human progress. Every invention or true innovation makes us more generally intelligent than we were and thereby increases the creativity of all ethical persons. It enables us to make better use of the resources left, in effect increasing the resources at our disposal. However, technical innovation can make unethical persons more destructive, since it can increase their intelligence without increasing their ethics. The latter makes some persons fear science and technology.

Fear leads to a lack of confidence in our own creativity and a mistrust of the creativity of others. Our classical brain, our intelligence, enables us to learn and repeat complex patterns of behavior. Our quantum brain, our ethics, enables us to innovate and invent new patterns of behavior, but at the cost of constant, false negative feedback from any bureaucratic society. Therefore, many persons close off their quantum brain and just repeat over and over again previously successful formulas of behavior once they have been learned. That is why socially approved ritual is so satisfying to so many persons. That is why so many persons are so destructively conserva-

tive and will not innovate even when they are about to be destroyed by a lack of innovation. That is why the ruling elite in every country, once established, whether leftist or rightist, become conservative and uncreative. (See *Leftist*, *Rightist*, *Conservative*, and *Liberal* in the Glossary.)

Ultimately the end result of fear is to destroy ethics by putting an absolute block between our quantum brain and our classical brain. Fear always brings about what we fear most.

A corollary is that "professional" investors driven by fear of losing money will usually do more poorly than if they had invested at random. That is why endowments and pension funds which tolerate no losses do more poorly than the stock market itself.

Once we mistrust our imagination we also mistrust our ethics. Instead we then depend on self-deception and deceiving others to be happy. The greatest fear becomes the fear of losing our delusions. The greater our intelligence the greater our capacity to deceive ourselves and overcome all evidence contrary to our delusions. We then use our Imagination (I) only to maintain our delusions. Whatever information comes through our quantum connection is distorted so as to help us maintain our illusions. Fear destroys by paralyzing the quantum brain and distorting all truth into self-delusion. The only antidote to fear is love.

Love

Love and fear are the only emotions that exist. All emotions from greed, jealousy, and hate to sorrow, pity, and compassion are combinations or manifestations of these two primary emotions. Love is the desire for and the act of helping another person increase his/her creativity. Anger is the conscious manifestation of the unconscious belief that we cannot love creatively. To love creatively is to be able to help a person overcome her/his fear and as a consequence become more creative. Anger is the last and most difficult fear we overcome. However, anger and its longer-enduring manifestation of hate can never be overcome alone. We can only overcome them by loving others, particularly our enemies.

An enemy is any person who is destructive to us or to those we love. To love an enemy is to help that person overcome his/her fear so that he/she may become less destructive and more creative. This is an extremely difficult thing to do. Even Jesus was not able to love his enemies sufficiently to keep them from killing him. Our enemies also have free will and the right to remain destructive. Because $C = IE$ (and so long as $E < 1$ we can behave destructively), we get the greatest creative effect with destructive persons by helping them increase E rather than I. This minimizes their destructiveness while increasing their creativity. So long as $E < 1$, too much intelligence can be disastrous; this is particularly true when persons who are ethical and intelligent put their creativity at the service of destruc-

tive persons and organizations. This is common when E < 1. Unethical persons use the remaining fear of ethical persons to control their creativity. Furthermore, I is itself dependent on E. Increasing E increases Imagination (G) and Will (W) directly plus Memory (M) indirectly. In order to love our enemies effectively, they must trust us. They will never trust us unless we love them from our soul.

The soul is our true self, which takes its identity from our quantum connection to God, our ethics, and our creativity. The ego is our false self, which takes its identity from the persistence of our Memory (M), our intelligence, and our happiness. The ego sees itself as the set of all our memories, our happy, unhappy, and trivial experiences. Our ego seeks to maximize our happy experiences. Our soul seeks to maximize creativity. Our soul and our ego are both part of our mind. When we die our soul lives on in the creativity that we have engendered in others, but our ego is totally extinguished, since only our creative acts can survive in our species and in us as a part of God. Remember, we create God as God creates us.

We overcome the entropy of our ego by valuing creativity over happiness. When we are moral, we no longer have an ego but are guided entirely by our soul. Ego is an interaction between our Intelligence (I) and our desire for happiness. By eliminating our desire for happiness we free our mind to be maximally creative. Our Intelligence (I) is no longer burdened with supporting our ego. It becomes a purely creative part of our mind. Our Will (W) is then entirely driven by our soul. So long as our ego is part of our Will (W) we behave destructively, but ever less so as we value creativity over happiness. Creative Transformation catalyzes this process of overcoming the entropy of ego.

<u>Corollary</u>: As we undergo creative transformation our Memory (M) improves. A declining Memory (M) is one side effect of ethical decay. Memory (M) can obviously also decline in other ways unrelated to ethics.

Ultimately, perhaps, our body dies because our soul dies—not necessarily the other way around. Our soul is immortal, if we do not kill it. We can kill our soul only by deliberately choosing to destroy our quantum connection to God. This is the only Hell there is. Only morality can engender immortality [280].

Persons who value their ego over their soul are always afraid, because ultimately, no matter how we try to fool ourselves, we all know that our ego will perish with our body and we will have no more personal experiences or happiness. That is why most persons fear death. Only those who can find total satisfaction in engendering creativity in others can overcome their ego and all fear. These are persons who value what they do over what they experience. The soul is action-oriented. The ego is experience-oriented. All others will compensate for their fear and attachment to ego through self-delusion. Self-delusion can always provide a happy experience. These delusions include a belief in an afterlife in which the ego survives as part of the

soul, as some of the leading religions teach, or a belief that there is no meaning or purpose to the universe and that we each have no obligation except to ourselves, as some modern, atheistic existentialists teach.

These delusions also include the beliefs of those communists who teach that they have discovered the ultimate deterministic laws of human history and how to control it. Remember that history and evolution are nondeterministic quantum processes. The communists then expend the energy of their society to forcefully prevent the dissemination of any evidence that they may be wrong. In this way the communists destroy their negative feedback and the creativity of their people. They relieve their fear through the delusion that they know where we are going and how to get there. Some communists live in fear and use force, fear, and deceit to rule. Whatever engenders fear also destroys love.

It is fear and lack of love between East and West that now threaten to destroy humanity and perhaps the biosphere. When was the last time the alleged Christians of the West tried to love their enemies? When have the communists loved and trusted their own people, let alone their enemies?

To love from our soul is to convince the persons who are destroying love and truth that we can and will help them overcome their fear and be more creative because we share a common quantum connection; we value them unconditionally as individuals who are part of God. Whatever increases the creativity of one person increases the creativity of all. No one can lose from the increase in anyone else's creativity, except possibly those who exercise power through fear. Even they will eventually benefit by losing the power which corrupts them. It is necessary but not sufficient to go through the motions of love in order to help our enemies; it is necessary and sufficient to feel this love in our soul and act accordingly. Then our enemies will feel this love in their soul. There is nothing we can do that will increase our creativity more than loving others, particularly our enemies. This is the only way we can eventually overcome all fear. We cannot become moral by ourselves, but only by helping others become moral through love.

When we love from the soul, the creative act of loving is its own reward, and we seek nothing beyond it. When we love with our ego, then we see love as an exchange where we give no more love than we receive. Ego-based love leads to the absence of love. Ethical or true love, which comes from the soul, is always unconditional. When we love ethically we always focus, with no concern for our ego, on what will maximize the other person's creativity; in the process we maximize our own.

The currently exploding divorce rate, together with the growing inability to make loving commitments, is a manifestation of fear by which all persons are driven to love only from their egos. Our society is destroying everybody's quantum connection to God. This makes it ever more difficult for persons to love from their soul. When people love only from their ego, love is false and does not endure the test of time.

Love is the extension of all autopoietic quadratures by which two or more previously self-centered evolutionary entities choose to help themselves by helping another and in the process create a new, higher collective evolutionary entity greater than the sum of its parts. This is how DNA and protein created life, how single cells created the metazoa, and how single human beings shall create the Ethical State and the Moral Society. All evolution depends on choice. The most important choice we ever make is to love rather than to fear. This is the only choice by which we never lose. It is a choice to play the Game of Life.

How To Begin

Creative transformation begins with four essential steps. Each step helps us become more creative and leads eventually to the creation of the Ethical State. We can take some of the steps by ourselves, but the process can only be completed in a group of four men and four women. For the reasons given before, four men and four women are the optimal number for beginning autopoiesis at the super-metazoan level. However, we can make progress toward creative transformation in smaller or larger groups.

Couples are usually too small a group. They find it easy to accept common delusions. Still, we are better off in a couple than we are alone. Groups larger than eight soon begin to create a hierarchy whose members find it difficult to treat each other with equal respect and to communicate on a personal level, soul to soul. It becomes almost impossible for groups larger than fifteen. Larger groups should be broken down into smaller groups, preferably of eight each. Therefore, if the process is to be optimized, it should involve four men and four women who freely choose each other and agree to work together to become creatively transformed. Persons who have difficulty creating their own groups of eight may expect help in forming groups of eight from those who have already begun the process.

The four steps are as follows:

1. Deliberately choose to live by the evolutionary ethic and make every decision on the basis of what will maximize creativity for ourselves and others; make a commitment to play the Game of Life. This facilitates our making commitments to others.
2. Do our best to love others, including our enemies, by interacting with them on the basis of what, in our best judgment, will help maximize *their* creativity, and by opening our soul to them, while respecting their freedom of will; make an unconditional commitment of love to others, focusing on those groups of eight to which we belong. We choose to love rather than to fear.
3. Learn the nature of fear and how it manifests itself in everyone's destructive behavior, including our own. Then focus on how we

can learn to overcome fear through taking our identity from our soul instead of our ego, and by doing our best to maximize creativity, without any other considerations; we choose to reject fear as a motivator of our actions. Only humans can do this.

4. Engage in autopoiesis as best we can. This feeds back to the previous three steps and helps us better achieve them; those steps in turn further enhance the autopoiesis, which is an ongoing process.

Creative transformation is therefore a self-catalyzing process based on ethical love; its spirit is communicated in these four steps, but its practice transcends any given technique. Still, there is a technique that has been experimentally developed to help persons get started. Each group of eight can then modify the technique to suit its own particular needs and innovative inclinations.

Never turn a technique into a ritual.

Remember, each person has the same quantum connection to God. We may each need a group of eight equal partners to maximize our creativity, but no one needs a "guru" (see Glossary). Indeed, any attempt to lead the process destroys it. Within the group of eight we are each our own guru. To bring about this state of affairs, we must each learn to synchronize our four complementary pairs of brains to produce autopoietic coherence among the eight persons participating in the process.

Brain Synchronization

The objective of creative transformation is to eventually create a collective creative intelligence that is greater than the sum of its parts and in such a way that each individual is more creative than he or she would be alone. As in all creative endeavors, everyone wins something and no one loses anything. The intermediate stage for creative transformation we call the Ethical State. The final stage we call a Moral Society. The first stage is the process of brain synchronization, the establishment of quantum coherence.

Brain synchronization in the group of eight, which for convenience we will call an "octet," means that the eight persons have simultaneous but complementary thoughts which enhance one another, just as coherent photons enhance one another in a laser and enable us to create holograms. Both processes are macroscopic quantum phenomena. Each person in an octet reflects the hologram produced by the octet. The octet is part of the Universal Hologram produced by God. The four steps previously given help produce this brain synchronization, one brain at a time, to create a new quantum hologram of coherent thoughts among the octet.

There may be other and better beginning steps; I have not found them. This technique works for some persons; it does not work for everyone. As we shall show, the technique is logically coherent, but it was not

discovered by a purely logical process. In retrospect, I could derive the process of creative transformation linearly and entirely through logic and science, but that would not maximize your creativity. The creative process is basically an irrational, nonlinear process. The logic and science come later to test the validity of our basic insight. We create through ethics, we reason through intelligence. Both must work together to produce creativity and prevent self-delusion.

The process of creative transformation came to me in a series of dreams over a period of one week, after I had been working intensively for about four months to understand and meld the new physics with evolutionary ethics and teach this to others. The first dream expressed itself in a poem. I had not written a poem for fourteen years. In 1970 I wrote a poem in conjunction with *The Moral Society.* That poem summarized evolutionary ethics and my book by describing Spinoza's life. The poem became an epilogue to the book and was printed within it. I reproduced these poems on page 38 in the Introduction. The newer poems summarize the process of creative transformation. As is obvious, poetic expression is alien to my nature. I prefer clear, concise, unambiguous prose. Yet on rare occasions my quantum connection forces me to express myself in poems I do not fully understand, but whose multiple meanings are revealed over many years. All poems, which resulted from two such occasions, appear in the Introduction on page 38.

The next idea that occurred to me, again in a dream, was that autopoiesis at the super-metazoan level was an analog of a carbon atom; that in order for it to occur we had to have the equivalent of covalent bonds between complementary pairs, such that it was possible to have a group of men and women (the complementary pairs) with each man communicating simultaneously with four women and each woman communicating simultaneously with four men and all communicating with each other, somewhat like a carbon crystal. I could not imagine how to accomplish this even though I worked for months with many possible geometries of groups in two and three dimensions and ranging up to 128 persons. The best I could do was to come up with the geometry expressed on page 223, which makes it possible for each person in an octet to communicate simultaneously with three persons of the opposite sex and one of the same sex.

It occurred to me during the week of "revelations" that the right size for the group of men and women was eight. I had not yet consciously seen the pattern of evolution by groups of four complementary pairs, or their correspondence with mandalas. I knew almost nothing about mandalas. It turns out that four pairs of men and women is the only optimal arrangement there is. Neither larger nor smaller groups will allow each person to simultaneously communicate more effectively with four persons of the opposite sex and all to communicate with each other.

Finally, at the end of the week, I had a dream in which "Meditation"

and the "Creation" couplet (reproduced with the poems on page 38) came to me. I had no idea yet what the creation couplet meant. It was the first time I had realized that for humans fear is the belief we cannot create and that this belief is an illusion.

A similar idea was expressed in a book of Christian mysticism called *A Course in Miracles* [862]. When I first read this book I had a strange feeling that I had written it in the future and sent it to myself in the past (a quantum concept). The book was in fact written anonymously by a woman I never met, a Jewish psychotherapist who had died a few years earlier. She claimed to have written it over a period of ten years in response to a voice she heard when she was alone. As a psychotherapist she kept this to herself and one male confidant, another psychotherapist. She arranged to have the book published anonymously shortly before she died. It is a book with a powerful message for Christians or ex-Christians. Yet almost all the key persons involved in writing and publishing the book were Jewish (another example of Jewish catalysis as in Chapter 4). I was moved by *A Course in Miracles* even though I thought the book had some shortcomings. The author seems to have known too much psychofraud and not enough science. It may be that no revelation—however true—is devoid of errors. That is why we need science.

Insofar as my own revelations were concerned, I had clearly thought of some innovative behavior that might lead to higher consciousness. I saw absolutely no possibility of harm in this new behavior. When I communicated this to my close friends, most expressed fear and did not want to have anything to do with it. My personal image before others at the time was that of a highly rational, nonmystical person. Even those who were mystically inclined thought I had gone too far. No idea I have ever expressed seems to have aroused so much fear as supermetazoan autopoiesis. All this made me think that I probably had worthwhile ideas. It took me six more months of trial-and-error attempts to get a group of eighteen persons, mostly strangers to each other, together to try the experiment. I wanted redundancy because of the fear my ideas had, until then, engendered in almost everyone who had become familiar with them. I expected that at least half of these eighteen persons, who had been recruited by newspaper advertising as experimental subjects, would be scared away as soon as I told them what I wanted them to do. However, I had learned how to lessen fear in the previous six months as well as how to recruit experimental subjects. Only six persons dropped out after the first day. Eventually I was able to consistently recruit experimental subjects and teach the process to others with no dropouts (see Appendix).

The way I set up this first experiment was that I invited all the persons who applied to spend six days, all expenses paid but no salary, at a large, luxurious ranch, to participate in an experiment for enhancing creativity. I prescreened the applicants by having them all first read *The Moral*

Society and some also *Psychofraud and Ethical Therapy* to get a general idea of my values and theories. I also had all applicants fill out an application form similar to the one given in the Appendix to help match applicants with common interests. Then I invited them to the ranch and we interviewed each other. I rejected no one. All persons screened themselves in or out, as I provided full disclosure as best I could. Through this process we reduced the number of applicants from 100 to 18 over one month.

The first day of the experiment I gave them an intense four-hour audio-visual presentation that summarized this book up to now. The presentation is outlined in the Appendix. Six persons dropped out after that, clearly frightened and disturbed. The other twelve stayed until the end of the first experiment five days later.

The next five days were spent on brain synchronization. Because there were now only four women and eight men left and I wanted the experiment done under optimal conditions, I had the four women choose the four men with whom they would like to engage in autopoiesis. The four men left out, including me, were to be observers. One woman was married and chose her husband, as one would expect, although I had emphasized that autopoiesis was completely nonsexual. Two of the other women chose men they had met for the first time that week. One woman, who was a personal friend of mine, chose me, much to my surprise, and the other women backed her up. At first, I had intended to be an outside observer along with the other men; but I decided to go along with any unexpected results produced by the process I had started, not wanting to interfere with the quantum nature of the process. Therefore, I became an observer from the inside instead of the outside.

Then the eight of us proceeded to synchronize our individual, four-paired complementary brains within the octet, one brain at a time. This process was to be refined and improved through trial and error over the next four years as we did subsequent experiments. However, the changes are more in style than in substance. The main thing I have learned is (1) how to better inform persons about the process so that those with high fear levels screen themselves out before the workshop, and (2) how to lower the fear of those who remain. We can now accomplish everything in two-and-a-half days of teaching and participatory seminars (see Appendix).

The synchronization of the highest brain, the neocortex, which is the center of ethics, is achieved by having a common system of ethics derived from the evolutionary ethic. This is difficult to accomplish.

I had already written three books on the subject, one unpublished, parts of which were to mutate into this book. The other parts remain unpublished. All the participants had read one or both of the two published books, plus a shorter version of the material in the Introduction to this book. They agreed in principle with the evolutionary ethic. However, at the time of the interview I saw that most of them obviously did not understand

the material, nor did they, with the possible exception of one woman, overtly attempt to practice the evolutionary ethic. They were apparently all decent persons. Still I did not want to exclude anyone who wanted to participate in the experiment. I hoped that the autopoiesis would generate feedback and help them be more creative. This was one of the main objectives of the experiment—to see what could be accomplished by autopoiesis within an octet.

To enhance their sense of the evolutionary ethic and to synchronize the neocortex between them, I had them apply the evolutionary ethic together with the Eight Ethical Principles to solve three ethical problems by consensus over the next three days. These problems were how to apply the evolutionary ethic to solve the current problems of (a) economic survival, (b) education, and (c) sexual relationships. Almost all the octets that have participated in the creative transformation experiments to completion have done well in theoretically solving these problems, but few have done as well in applying the ethical principles to their own lives. The exceptions have been those who were able to integrate themselves into an octet. In this and other exercises it is important that persons reach their own conclusions, and that they not be led.

Later on, when I trimmed the six-day seminar to two-and-a-half days, I had the participants work on only one problem of their choosing. Persons under thirty would usually focus on sex, and older persons on economics or education. Some of the older persons seemed embarrassed by discussions of sexual ethics. In the next two chapters I apply the evolutionary ethic to extend the creative transformation process to the areas of education and economics. I leave the simpler problem of sexual ethics as an exercise for the reader.

As a hint in solving the problems of sexual ethics, I might add that a general consensus (not necessarily correct) of the octets was that (1) sex without love is unethical; (2) love without sex is ethical; (3) love always involves commitment; therefore, (4) sex without commitment is unethical. A less obvious conclusion was that (5) sex totally unrelated to reproduction might at best be trivial and at worst destructive. You may use the examples of the next two chapters plus the ethical theory of Chapter 3 to derive your own analysis about sexual ethics. A final general, but not universal, conclusion was that (6) ethically committed, heterosexual monogamy is the most creative form of sexual behavior, contrary to the "Playboy Philosophy" and recent popular practice. These conclusions were surprisingly conservative compared to ethical conclusions in other fields. A corollary is that we should not expect to find love through sex, but that we should learn to love from our soul and make ethical commitments before experiencing sex, if we are to be maximally creative as a couple. The fact that this is rare is a defect in our culture. One consequence is a high divorce rate leading to many millions of single-parent families.

After the exercises for ethical synchronization of the neocortex by learning to practically apply the evolutionary ethic, we went on to try to synchronize the mammalian cortex by learning the ethical meaning of love. We explored the meaning of love in the ethical sense of what it means to be loving and to feel loving by experiencing and doing our best to help others maximize their creativity. We, and all subsequent groups, concluded that we are all helped more by the love we give than the love we receive. For love to be meaningful it must be unconditional and selfless. At the same time, true love requires that we give negative feedback to persons we love when they are destructive. We must also give them fair opportunities rather than alms. The latter are destructive to the creative process. The great challenge is to give negative feedback with love and humility and not with anger and arrogance. It also takes much more creativity to provide fair opportunities for others than to give them alms.

After extensive discussions among ourselves we all signed the contract for creative transformation (see page 256). I had prepared this contract before the experiment, but I wanted them to reach their own conclusions and modify it if necessary.

All successful octets have signed the contract essentially as is. Groups who did not sign the contract, or extensively modified it for any reason, have all failed in creative transformation. The reasons for this are apparently not inherent in the nature of the contract, but are more related to the fear of persons who refuse to sign such an innocuous contract, which no ethical person should fear. However, not all who signed the contract succeeded. You should try to improve the contract.

After signing the contract, we sat in a circle of eight and each made a personal commitment to the other seven, one at a time, promising to do his/her best to maximize the creativity of each person in the group of eight. It was an emotionally moving experience in which most of the persons, including myself, cried and had their souls touched. I had not cried in thirty years. Subsequent commitments with other groups have not been as emotionally moving. It may be that a full week devoted to the creative transformation workshop is always best. However, in the long run, the two-and-one-half-day workshop seems adequate and a better use of resources. The long-term effects seem about the same. Up to now a majority of each group eventually drops out of the process, usually because they do not receive enough benefits fast enough. Creative transformation is not magic.

Next we addressed the problem of fear and tried to synchronize the reptilian brain. Fear is an emotion that usually divides us. Fear can apparently only unite persons in collective destructiveness, as Hitler, the communists, many "democratic" politicians, and lynch mobs have discovered. This problem is the most difficult to solve and was not well handled at that time. Many of the persons in the first experiment had very deep-seated fears which were not addressed. Later I was able to get persons to speak

more openly of their fears, and help them see that they were always based on self-delusion. They always had the ability to create solutions to their problems and overcome their fears if they wanted to, and the other persons in the octet were supportive in the process.

In the many hundreds of persons who have participated in the creative transformation experiments, the only apparent common denominator in the octets that failed, or in individuals who dropped out of the octets

C O N T R A C T
For Creative Transformation

We, the undersigned, promise to do our best to help one another maximize our creativity. Toward this end we promise to educate and help one another and to tell one another the whole truth and nothing but the truth to the best of our ability. We shall give each other honest and constructive feedback about how to improve our behavior. We shall accept all such feedback from each other in the same loving spirit in which it is given. We shall make no judgment about the ethical nature of our seven teammates, but only do our best to help them make their objective behavior more creative. At the same time we will be honest and forthright in expressing our feelings to each other, recognizing that our expressed feelings about anyone communicate more about what we are than what that person is.

If we should ever wish to disassociate from this group of eight persons, we will do so promptly, giving at that time to the other seven persons our full true reasons for the disassociation. After disassociation from these persons, we have no further obligations to them other than those we choose to assume. The remaining persons may at that time incorporate other persons to take our place without any further obligations to us other than those they choose to assume.

So long as we are members of this group of eight persons, we promise to do our best to treat every person outside the group with whom we have dealings the same as we treat persons inside the group. We will share these experiences with our teammates.

We promise to ethically love and serve one another. We shall do our best, knowing that we may often fail, to ethically love all humanity, including our enemies, who decrease our and others' creativity. We are fully committed to maximizing the creativity of all humanity, but we agree first to begin with ourselves.

AGREED

SIGNATURE	DATE	SIGNATURE	DATE

that succeeded, was fear. The greatest fears have been in giving up apparently rigid, delusionary belief systems, i.e., false paradigms, which seem to help orient the person while giving his/her ego a seemingly false sense of self-worth and personal identity. The worst of these systems seem to be those of mystical specialists, who appear totally open to almost any kind of nonsense but are closed to scientific feedback. They will believe anything that makes them happy and disbelieve anything that makes them unhappy, with no regard for objective evidence. We have had no trouble recruiting mystical specialists for our experiments, but we have never had long-term success with the mystical specialists who reject scientific method as in any way being relevant to their mystical experiences. The mystical specialists seem invariably more interested in what they experience subjectively than in what they accomplish in the objective world. It seems that persons who take their identity from their beliefs (paradigms) rather than from their objective ethical actions always have too much fear to succeed in creative transformation. Remember, ethics are based on goals, not beliefs, and it is unethical to be certain.

The best we have been able to achieve in our seminars and workshops is to help most persons recognize that they are operating out of fear anytime that they act destructively. Fear always causes persons to bring about that which they fear most. Fear always stems from the belief that we cannot creatively cope with the situation which produces the fear. As the creative transformation process goes on, the octets help their members face up to their fears and overcome them. Those who cannot face up to them leave. Unfortunately, this is a majority of the participants.

The experimental evidence, so far, is that the creative transformation process will work for everyone who is not too afraid. At this time, based on my personal observation in the West, about 80 percent of the general population seems so afraid of the process that they will not even try it. This fear should, however, rapidly diminish as more octets are created. The new is always more frightening than the commonplace.

The most pernicious fear seems to be fear of giving up false, ego-based models of one's personal identity. Ironically, these false models destroy a person's creativity and make a person even more destructive. The single most common and most destructive false belief system I have found among our participants, and there are many others, is the belief that the person is a hapless victim of environment and that *other* persons and bad luck have kept him/her from being more creative. These people believe that, if someone would only give them a chance, they could be creative. They believe opportunities are given by others, not created by ourselves.

In this belief, which I call the "victim paradigm," the persons are denying their free will and their quantum connection to God. They are also violating the first rule in the Game of Life (see page 206). There is nothing more destructive that persons can do to themselves. *Persons who cannot*

accept 100 percent responsibility for their life and the consequences of all their actions or inactions and assume that whatever happens to them is self-caused will never be creatively transformed. These persons generally receive negative feedback within the process and leave the octet, no matter how lovingly the negative feedback is given. I have never known of a highly creative person who had the victim paradigm. I have never met an uncreative person who was free of it. We can all become free of it by assuming responsibility for our own life. The easiest way to do this is to *choose* to play the Game of Life. We clearly have it in our power to choose to do so. We can all reject fear as a motivator. That is what makes us human.

A corollary to the "victim paradigm" is "the savior delusion." Persons who believe the victim paradigm almost always tend to see all persons as either oppressors or as saviors. When they see them as saviors, they assume that their savior will right all the problems in their life after they accept the savior. We can only *help* persons change themselves. No one, not even God, can unilaterally change another person, because we all have free will. The savior delusion always leads to disappointment, and the savior is then turned into an oppressor. The victim paradigm remains intact.

Persons who have fear, but not too much of it, can, in time, overcome their fear through the creative transformation process. The dividing line of fear between those who succeed and those who fail in creative transformation seems to be persons who can overcome the victim paradigm and make a sincere commitment to play the Game of Life. Otherwise, their fear is too high. Any person who can honestly begin the creative transformation process and stick with it will eventually overcome fear and fully succeed. It is not necessary to believe in the process in order to succeed. It is only necessary to have patience and to not be too afraid, particularly of negative feedback. Perhaps someday someone will find how to help those unfortunate persons whose lives are governed by fear and who cannot make a sincere commitment to play the Game of Life. They do not have to be proficient in the Game of Life. The most rank amateur beginners in the Game of Life can successfully engage in creative transformation. They merely have to lower their fear enough to try the Game of Life.

The final brain synchronization that occurs is that produced by the autopoiesis itself. It works directly on the most primitive of the four brains. Simultaneously, autopoiesis contributes to the synchronization of the other three brains, if the previous three steps have been complied with even to a slight degree. As the autopoiesis progresses it catalyzes itself by making the persons more ethical and creative, more loving toward others in and out of the octet, less afraid of situations and others in and out of the octet, and by producing an increasing amount of synchronicity in each person's life.

Synchronicity is a Jungian term referring to the occurrence of meaningful coincidences which further enhance the creative process in our life. It is another quantum phenomenon that can be attributed to the moral

order in the universe as well as a two-way communication between our quantum connection. Our unconscious receives the information from the implicate order and communicates to others through their quantum connection to cause or put us in situations which will produce what we need to enhance our creativity. Fear causes the opposite of synchronicity.

In autopoiesis the eight individual members of the octet integrate their individual quantum connections into a single collective quantum connection that serves as a lens for focusing the infinite information flowing from God into a finite image within the local universe. We each use our quantum connection to project through the lens of our imagination a finite random image onto our intelligence (our classical brain) from an infinite source of information. The deeper and broader our intelligence and the greater our ethics, the less random and more meaningfully important this projection will be. Our intelligence determines the size and depth of the projection; our ethics determine the relevance, coherence, and fidelity of the projection. This is how we create, C = IE. In autopoiesis we do this collectively within the octet and project, the quantum information more accurately and deeply than is possible or comprehensible for any individual. In autopoiesis we must distinguish between information that is coming from our quantum brain and information that is coming from our memory.

Our memory is part of our ego and our classical brain. It is a component in our intelligence. We cannot be effective in the objective world without using our classical brain. We cannot be creative without using our quantum brain. The classical brain consists primarily of the three lower brains and part of the neocortex. The human quantum brain is entirely in the neocortex, primarily in the frontal lobes, although as we mentioned earlier there are lower-order quantum connections in all other brains and in the neurons themselves.

The classical brain learns by conditioning or under direction of the quantum brain. The quantum brain always knows. The classical brain, once it knows how to solve a problem, always wants to repeat the same solution over and over again every time it encounters a similar problem. This repetitive, uncreative behavior occurs because the classical brain includes the reptilian complex and is subject to being governed by fear. The classical brain is very reliable and almost always works, unless it encounters a radically new situation which requires creativity. The quantum brain is a random generator of true information. It becomes ever more derandomized as we become more ethical, which means that as our ethics increase we imagine exactly the true information we need when and as we need it. However, we can never depend entirely on our Imagination (G) because we cannot increase Ethics (E) unless we also increase Intelligence (I) by doing our best to learn, teach, and create.

Therefore, once persons have learned a repertory of essential skills (e.g., obtained a Ph.D.) that enables them to survive, many tend to close

off the unreliable connection between the quantum brain and the classical brain and to depend almost exclusively on the classical brain. This is why, when lobotomies were first performed, medical experts could not detect any deleterious side effects; so many persons do not use their quantum brain anyway. Eventually persons saw that lobotomies produced a decrease in the ability to make ethical judgments and to display creative imagination, things that many people do not do. An unethical culture produces psychosocial lobotomies.

The Quantum Dialogue

In order to prepare persons for autopoiesis we performed an exercise I called the "Quantum Dialogue," which I first learned in part from Amit Goswami. In the Quantum Dialogue we encourage persons to use their quantum brain by responding to a question not with the first answer that comes to mind but by inventing an original response. The first answer is usually a reflection of memory and is controlled by the classical brain.

Almost all of us rely on the classical brain to have a conversation. Our classical brain usually works smoothly, quickly, and reliably. It gives socially acceptably answers to questions. Our quantum brain often works unreliably and slowly, eventually producing short, staccato bursts of information after long periods of silence. This information is often socially unacceptable, and may seem unrelated to the question or problem at hand. These quantum answers may in fact make us appear strange or even insane. This is why persons are so reluctant to use their quantum brain.

Some persons have great difficulty with the Quantum Dialogue. This difficulty is a reflection of how much they have blocked off their quantum brain. After rejecting their first classical answer to a question they cannot invent a second answer. But all can succeed if they keep trying. Other persons find it very easy. This exercise usually makes persons conscious of their quantum brain for the first time in their life and facilitates the autopoiesis, which usually follows within the next few hours during our experiments.

We produce the Quantum Dialogue by sitting the octet in a circle and having each subset of seven ask any question they wish, one at a time, of each person in the octet, so that eventually each person asks at least one question of each of the seven other persons and each person gives at least seven quantum answers. We repeat the process as many times as necessary. It is essential that each person make a choice to set aside the first answer that comes to mind, and deliberately choose the very next thought or image that comes to mind, whatever it may be, as the quantum answer. The choice to reject the first answer and rely on the quantum brain opens the quantum connection.

There are four harmless ways that I know of for opening up the con-

nection between the classical and the quantum brain. There may be others. They are as follows:

1. The Quantum Dialogue.
2. Going to sleep while concentrating on a difficult problem that cannot be solved without the quantum brain and then waking up with the solution—which usually follows an apparently irrelevant dream that precedes the solution. The solution is a synthesis we make immediately after waking from the dream.
3. Focusing all our waking attention on solving a difficult problem that requires use of the quantum brain, but without any consideration of any reward for solving the problem or any punishment for not solving it. Extrinsic rewards and punishments are destructive to the creative process.
4. Autopoiesis.

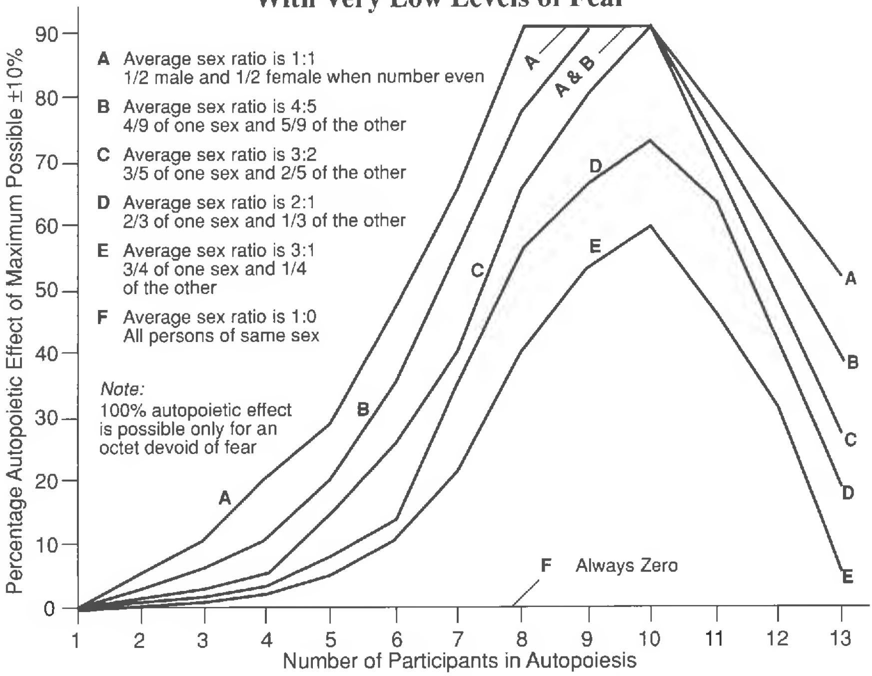
Other techniques which make similar claims, such as drugs or classical meditation, either do not work or seem to have deleterious side effects. For example, classical meditation seems to turn persons inward psychosocially, specializing them in predicting and controlling their own thoughts, while making them less loving and less creative in the objective world. Drugs almost always have adverse effects on our intelligence even if they liberate the quantum brain. The net effect of all these other techniques for stimulating the quantum brain seems to be a net decrease in creativity.

The Quantum Dialogue is the least creative way of opening the quantum brain without harm, but it is the easiest way to get a person in touch with his/her quantum brain. It helps synchronize the quantum brains of the octet. The second and third techniques above are personal. Our ability to use these techniques is individually increased by participating in creative transformation.

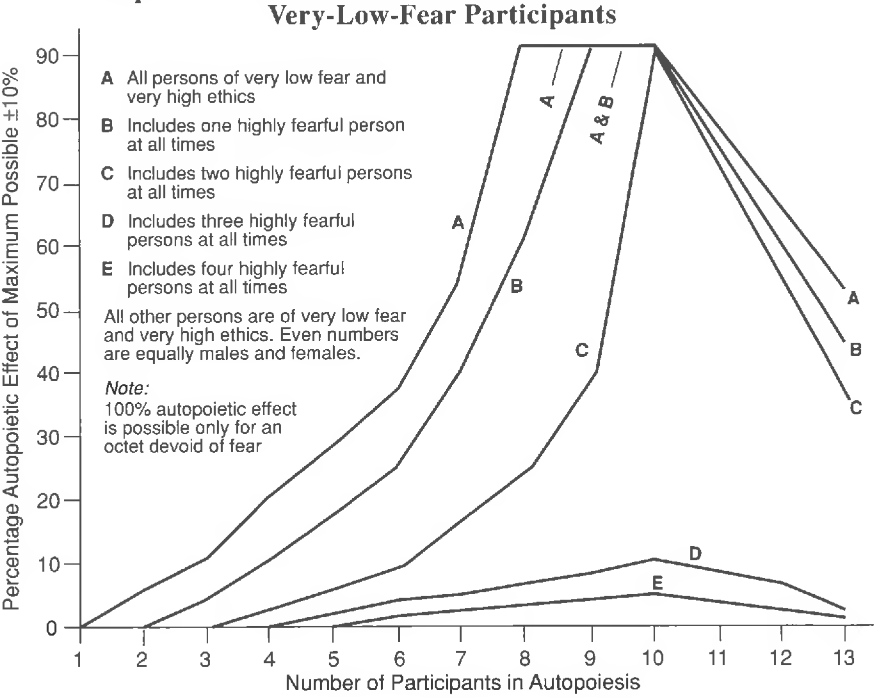
Quantum Octologue

Autopoiesis creates a collective, creative experience somewhat like a collective dream, in which persons speak literally as well as symbolically as they describe the insights, visions, and questions that occur to them. Autopoiesis is a coordinated, focused Quantum Octologue in which the quantum thoughts are not necessarily the second thoughts. It is a direct, real-time (almost simultaneous) synchronization of the quantum brains of the octet. We can distinguish quantum from classical thoughts because the latter flow smoothly and quickly in extended sentences and clearly reflect our memories, while the former are short, energetic bursts of original information which we feel absolutely compelled to communicate to the other persons in the octet. These are the kinds of thoughts we rarely have but which,

Autopoietic Effect for Various Combinations of Participants With Very Low Levels of Fear



Autopoietic Effect for Various Combinations of Fearful and Very-Low-Fear Participants



when we do, we usually keep to ourselves. The real-time sharing of these thoughts is central to autopoiesis. It has much in common with a Friends (Quaker) meeting, where all participants seek to speak from the "Inward Light." The major difference is that autopoiesis is a much more integrated and complete form of communication of quantum information.

Autopoiesis is a mystical, loving type of brainstorming where no one judges another, and all speak about their insights without fear of being wrong or considered stupid. During autopoiesis one of the manifestations of fear is to drown our and others' quantum thoughts in classical verbiage. This can be prevented by noting the above differences between quantum and classical thoughts and by keeping thoughts to ourselves until we feel absolutely compelled to express them. No one should be concerned about extended periods of silence. In autopoiesis it is better to be silent than to let our classical brain take over. What we want is eventual, full, harmonious interaction of the classical and the quantum brain. At first, the classical brain often fears the quantum brain. We should speak not to show how clever or "deep" we are, but only to communicate an important, original thought that we believe will help increase the creativity of others in the group. The ethical commitment to others helps liberate the quantum brain. The quantum thoughts, images, and questions will eventually come to us if we are ethically motivated and if we are patient.

Patience is required if autopoiesis is to work. For those who will be helped by autopoiesis, I estimate that a significant, irreversible, creative effect will take about two years of engaging in autopoiesis at least twice a month. It is unlikely that anyone would require more than four years. "Irreversible" means that our fear will never again dominate our ethics. It does not mean that a person has overcome *all* fear. However, the effects of autopoiesis will be powerfully felt the very first time by about 75 percent of the persons who try it and who have successfully gone through the previously described brain synchronization with the octet. This is an experience, but not necessarily a transformation. Remember, we seek only creative action; meaningful experiences are merely trivial side effects.

Approximately 25 percent of those who try autopoiesis feel no effects even after repeated trials. For them it is a neutral experience. Some of these persons, if they are not too afraid, can still contribute to the autopoiesis of others by simply participating in the process and saying nothing. The only truly difficult part of autopoiesis is accepting the strangeness of the process and trying it in the first place. This is how it is done.

Autopoiesis Detailed

After the very first autopoiesis, which was suboptimal and partially successful for only about half the persons, I quickly saw how it was possible to have a group of four men and four women all communicating with four

persons of the opposite sex and the octet as a whole simultaneously. I had not been able to solve this problem in the six previous months of trying. This was done by following the pattern of the creative transformation symbol, where the squares represent men and the circles represent women (see page 37). The straight lines contain the points of contact of each person with each of the four persons of the opposite sex. The eight sit in as small a circle as possible, with alternating males and females, each with bare hands and feet. Each person holds the hands of the persons next to him/her and touches with each foot one of the feet of each of the two persons opposite him/her of the opposite sex. (See Appendix for more details.)

This synchronizes the most primitive of the four brains, the fish brain, in an eight-way flow of information through touch. Each person in the octet is touching four persons of the opposite sex. The fish brain began evolving long before our ancestors had noses, ears, or eyes. The primary modality for the exchange of information for this brain is the sense of touch. Touch is also the only modality of communication which does not seem to produce incoherence and confusion when eight persons simultaneously communicate with one another in real time.

Autopoiesis is enhanced (although this is not essential) by producing further coherence with music played softly during the process. The *Art of the Fugue* is the ideal music since it expresses the process of evolutionary autopoiesis, leading to ever newer and greater hierarchies of evolution through quantum leaps of four complementary pairs. It is a musical mandala. If anyone expresses a dislike of the *Art of the Fugue*, it is best to play no music at all, although such a person is not likely to ever successfully engage in creative transformation.

Additional coherence is produced when (1) all participants consciously decide by mutual consent to focus on a single problem during the autopoiesis, and (2) prior to beginning the autopoiesis all participants brainstorm the same problem classically until no one in the octet has any more classical ideas on the subject.

There are many other possibilities for enhancing coherence, from reading and understanding the creative transformation poems and concentrating on the creative transformation symbol (page 37), to following one's own instincts. All participants should feel free to experiment with the process through consensus.

Note: *Do not turn a communication technique into a ritual.*

Autopoiesis becomes increasingly easy with practice, requiring ever less effort for the octet to achieve coherent quantum thoughts. I suspect that eventually there may not even be the need of physical contact. We are working on a new technique which integrates the autopoietic octet by brainwave electromagnetic resonance rather than by touch. One of the main difficulties in the beginning with integration by touch is simply being comfortable. All members of the octet should be as relaxed and comfort-

able as possible; we have found the best way to achieve this is by having eight small but comfortable chairs with good back support in as small a circle as possible. Do not try to hold your hands in the air, but rest them on your legs or partner's legs. If you and the two persons of the opposite sex who are opposite you have trouble reaching far enough to touch feet, rearrange the circle so that the most long-legged persons are sitting opposite the appropriate, most short-legged. Experiment until you are comfortable. After a while you will all be able to get comfortable every time.

Part of the comfort is that the autopoiesis takes place in a quiet environment with no disturbances. Octets with young children should pool their resources and hire a babysitter to take care of the children so that they will not disturb the autopoiesis. The proper age for autopoiesis is at whatever age a person can understand and make a commitment to the Game of Life.

Typically it takes about five-to-fifteen minutes for the octet to get coherent, quantum thoughts, although it can take much longer. The time sense of the participants is often greatly distorted; usually, time seems to pass much more quickly once quantum coherence is achieved. But in the beginning many persons feel afraid that they are failing if they do not speak up. When this happens they always think, or worse, speak, from the classical brain. Fear always triggers the classical brain, never the quantum brain. Therefore, do your best to remain quiet in the autopoiesis until you learn to distinguish between quantum and classical thoughts. When you get quantum thoughts you will not be able to keep them to yourself. They will come back stronger and stronger until you express them. Then they disappear, and new thoughts or images take their place. When you have a visual or auditory image, describe it. These are also part of the process. There is nothing wrong with the entire octet remaining quiet and not speaking a word. There is no way in which anyone can fail, so long as he or she is committed to playing the Game of Life.

The objective is not to talk but to do your best to help the other seven in the octet to maximize their creativity. You are all constantly communicating with each other through touch. By simply participating in the autopoiesis without fear, you are contributing to the creative transformation of others and yourself. You will always succeed in this if you let your conscience rather than your fear guide you. You will find your personal creativity, in seemingly totally unrelated parts of your life, greatly expanded if you merely contribute as best you can to the autopoiesis without saying a word. The words will eventually come to you if you stop fearing that they will not come. Remember, you are in no way obligated to say a single word.

Your fear will drive you to speak up, to demonstrate how clever or knowledgeable you are, or even to make jokes. Resist this. Focus on what you can say or do to help the other seven be more creative. Forget about your ego. If nothing comes to you, or when in doubt as to whether your

thoughts are quantum, say nothing. The other seven will be focused on you, communicating through touch; this is how autopoiesis works at all levels of evolution. All autopoiesis represents a new form of communication among evolutionary entities that have reached a communications plateau.

Getting eight persons together at a given time and place is often difficult. Try to accommodate everyone, but subsets of the octet should get together at least every three weeks if the full eight cannot get together. This should happen even if the result is that only two persons get together. However, try to avoid getting together much more often than once every two weeks. This puts too much pressure on the participants. The experience should be rewarding and pleasant, not mandatory. It is play, not work. If autopoiesis seems like work rather than play, it might be best to drop out of the process for a while; it is not for everyone.

The autopoiesis effectiveness of the group is a function of the fear levels of the participants, the number of participants, their sex ratio, and their collective commitment to the Game of Life (see page 262).

For any group the autopoiesis ends whenever any person wishes to end it, with no questions asked or judgments made of the person ending the autopoiesis. Only mutually voluntary associations are creative. Do your best to avoid judging the contributions of others. Autopoiesis usually lasts about one-half hour, rarely running over one hour. At first autopoiesis may end because at least one person is becoming unbearably uncomfortable. Later it will last longer, and persons will learn to be comfortable for longer periods of time. Two hours is the longest autopoiesis I have observed. That one ended because of extrinsic events (a child crying). Feel free to experiment and innovate with the process. Remember, do not turn it into a ritual. The fact that completely different things are communicated each time makes it nonritualistic. The pattern of touching is merely one quantum communication technique. There may be better techniques. The only objective is to produce synchronized, real-time, coherent communication between the four complementary paired brains of the eight participants. Whatever optimizes this process is the right way. There may be several optimizing strategies. And we may not yet have discovered any of them. Autopoiesis is not magic; it is only one component in creative transformation.

The crucial goals are synchronization of the four brains through ethics, love, lowering fear, and whatever form of autopoiesis is best for you. If you fail in any of the first three steps, you will fail in autopoiesis. I have tried varying this peculiar arrangement of autopoiesis because so many persons are afraid of touching feet, yet it is a fear I have trouble understanding since only a few persons are afraid of touching hands. I have always found that every variation tried is less effective than the one suggested. Not touching feet as suggested seems to lower effectiveness by about 50 percent. A partial explanation for this last unexpected result follows:

Men and women are tightly locked into a mode of thought peculiar to

the brain structure of their own sex. Recent studies in embryology and neuroanatomy indicate that men and women have very different (complementary) brains [877-904]. Each has something the other sex needs, more at the mental level than at the sexual level. By everyone touching four persons of the opposite sex simultaneously, this complementarity of sexually-related mental differences is communicated. For the first time most persons experience that they can develop the perspective of the opposite sex. This clearly does not happen outside of autopoiesis when we touch only one or two persons of the opposite sex. Persons rarely touch three or four persons of the opposite sex simultaneously in an ethically loving context. This duality of perspective by which each person, at the mental level, becomes both male and female at the same time (a quantum concept) enhances the autopoiesis and the creativity of the group. It may be that we need to touch one person of the opposite sex for each of the four brains. Each cell in our body reflects our sexual differences as well as our complementarity.

These are the meanings of the creation couplet and the creative transformation symbol (pp. 37–38). When the four complementary pairs in autopoiesis become one through their quantum connections, they are all male and female at the same time. This produces a ninth collective entity that is both male and female and greater than any individual, but not greater than the eight. This is the octagon in the center of the creative transformation symbol. An octagon is between a circle and a square, which universally are female and male symbols respectively. I did not consciously understand these concepts when I wrote the poems and drew the symbols of creative transformation. Autopoiesis is a technique for producing quantum coherence between four men and four women.

The most important, practical advice I can give you on autopoiesis is not to try to control the process, but to flow with the process and let it work on you. The process is the product of eight persons and does not belong to any single person. Each member of the octet is an equal spokesperson for the entire octet. Anything you do as an octet should be done by 100 percent consensus, not by force of personality or majority vote. The autopoiesis will help produce the consensus.

Autopoiesis at all levels is a dynamic reminder that we cannot evolve alone. All intelligence is collective, from the collectivity of our four brains to the collectivity of the billions of cells that make up our body to the collectivity of the molecules which make up each cell. God is in turn the supreme, collective autopoietic process produced by all the beings of the universe who create God as God creates them. Similarly we must realize that we cannot become moral alone, but only by helping others become moral. We maximize our individual creativity by seeking to maximize the creativity of others. This is autopoiesis. This is what it means to love.

No matter how much others love us, we only receive the love that we give. We are benefited far more by the love we give than by the love bestowed on us. This is what Jesus meant when he said repeatedly that his

only commandment was that we love one another as he had loved us. Love is the extension of all autopoiesis.

A Do-It-Yourself Guide to Creative Transformation

Until now I have given the theory and the practice of creative transformation as it has developed since 1984. We now distill these experiences into the steps that bring about creative transformation and consider how we can tell when we have taken each step successfully. If you are scientifically minded and skeptical, as you should be, you may want to repeat my experiments independently. In order to help you rediscover for yourself the process of creative transformation without having to repeat my mistakes, I have given the details of my experiments in the Appendix. I now give you my best judgment as to how to proceed in the future. Feel free to innovate, but remember when you change the process you are no longer repeating my experiment but doing one of your own.

The steps to be taken all center around the four steps of (1) ethical commitment, (2) love of others, (3) conquest of fear, and (4) autopoiesis—all as previously mentioned. We will repeat these steps in a do-it-yourself context. The first step you must take is, therefore, a commitment to the evolutionary ethic that is more than lip service.

Step 1. We begin our commitment to the evolutionary ethic by agreeing to play the Game of Life. You should study this book and the rules of the Game of Life (see page 159). If you feel that you can in good faith agree to abide by the rules of the Game of Life, particularly the first one, then you are ready to begin creative transformation. If not, you are not ready. If you are not ready, you should then get into a discussion group with other persons who wish to engage in or are engaging in creative transformation and discuss the rules of the Game of Life and their implications until you feel in your soul that you can abide by them. If you can never abide by the rules of the Game of Life, then my best judgment is that you will never be able to successfully engage in creative transformation. If you do abide by them, then you are ready for the next step.

Step 2. Once you begin to play the Game of Life you will know that you are succeeding because you will feel an enormous decrease in subjective fear. This comes from the realization that you need do nothing more than your best to play the Game of Life and that your subjective best, whatever it may be objectively, is enough to win the Game of Life. Remember, this is a game that we win by playing, not by having some minimum objective level of proficiency. We can lose only by refusing to play. Playing the Game of Life does not mean that you have conquered fear, but merely that your fear has been lowered to the point where you can begin to love others from your

soul rather than your ego. You may still believe that you cannot love creatively. You will know that you have this false belief every time that you feel anger toward anyone, no matter how evil and destructive they may be. Very few persons in history have been able to love their enemies.

The second step involves learning to love your enemies, without tolerating their destructive behavior, by first learning to love your friends. The only true friends you will ever have are those who along with you have freely chosen to play the Game of Life. You must learn to have compassion for the fear within others that makes them destructive. You must do your best to open your soul to others without fear. The love you give to others from your soul will never hurt you. It is only when you love with your ego that you will be hurt. The second step involves becoming incorporated into a group of four men and four women who have freely agreed to play the Game of Life and have all freely signed the Contract for Creative Transformation between each other (see pages 159 and 256).

When you and your octet have freely signed this contract and have of your own free choice met at least once without feeling fear, anger, or any negative emotion toward one another, and you immediately stop any interactive behavior which is solely for your own benefit and not at all for the benefit of one another, then you are ready for the next step.

Step 3. The third step is the conquest of fear. It is the most difficult step you will take. It may take the rest of your life to complete it. It requires that you face up to your own fears and the fears of others. It requires that you give and accept negative feedback within and without the octet in keeping with the Contract for Creative Transformation. It requires that you recognize and give up the illusions that produce fear. When all within your octet have given and received feedback on their fears without feeling any anger toward one another, then you may be ready for the fourth step—which is autopoiesis. This does not mean that you have conquered fear. You have merely taken one more step on the way to conquering fear. You cannot control what you feel, but you can control what you do. You can reject fear as a motivator.

The third step requires that you choose not to act out of fear, but rather do what you sincerely believe will maximize creativity no matter how much fear you feel or how much fear ethical action may induce. This is, of course, difficult; simply do your best. Your best will win the Game of Life.

Step 4. You and your octet should engage in autopoiesis as soon as you wish. However, it will be ineffective so long as any person in the octet has failed to take any of the previous three steps, particularly if he or she cannot accept and give negative feedback on respective fears. Anyone who is afraid of autopoiesis itself has not even taken the first step. You will know that autopoiesis is working for the octet when all of you have and express new thoughts, images, and ideas during autopoiesis and when you

become more creatively effective in an objective part of your life. Once this occurs the creative transformation process will go on as long as you wish until you have created an Ethical State and a Moral Society. To have conquered fear is to never again feel fear or anger toward anyone, even our most destructive enemies. Through these four steps we will learn to love everyone from our soul—even our most destructive enemies.

The first three steps are of increasing difficulty. The first step is the only one you can possibly take alone. If you cannot create an octet around yourself, it is usually because you have not yet adequately taken the first step. The least you could do is repeat the experiments described in the Appendix. Whatever the case may be, there is free, ethical help available to you in taking all four steps.

A Strategy

You are not alone. If you wish to participate in creative transformation and you cannot begin the process by yourself, there is a growing network of persons who might help you begin by finding the right octet for you. In return, you will repay this service solely by helping others engage in creative transformation and create their own octet. Anyone who demands payment from you in any other way for this or any similar service is probably a person driven by fear who is likely to deceive you, or worse. All persons driven by fear, decrease your creativity and that of others. Anyone who seeks to control or in any way exploit an octet including his/her own for personal gain is more likely to be an enemy than a friend. Like all enemies they deserve our compassion and love, but not our cooperation in their destructiveness. When we love someone we must give them clear and unavoidable negative feedback when they are destructive, recognizing that they may be right and that we may be in error. If they refuse this feedback or its intent, then their own fear will drive them away from us. We should seek to help all persons overcome fear through ethics. We should increase the intelligence only of persons who are ethical.

Our universe seems to have a cosmic quarantine such that: (1) only ethical persons can be creative in the objective world (C = IE); (2) unethical persons and societies controlled by them destroy themselves, as humanity seems close to doing; and (3) stellar distances and physical laws are such that a technologically advanced society controlled by unethical persons is more likely to destroy itself before it can harm the independent, evolutionary experiments going on in the environs of the nearest (let alone distant) star systems. We should learn from this.

The evil-doers of the world are absolutely no danger to ethical persons, if we treat them solely with love. It is the ethical persons who are a danger to other ethical persons when they allow their creativity to be ex-

ploited by destructive persons. To persons who behave destructively we must give nothing but ethical information, which can only increase their creativity by increasing E. We must not increase the intelligence of persons who behave destructively except indirectly by increasing their ethics.

Creative transformation is a self-selective process that drives away unethical persons and attracts ever more ethical persons. A way of minimizing our destructiveness is to communicate nothing and give nothing—other than ethical information—to adults who are not actively engaged in the first four steps of creative transformation. At the same time, we are ethically obligated to make the process of creative transformation available to the maximum number of persons while rejecting no one. Unethical persons will automatically select themselves out, most of them almost immediately before even starting the process. A few may take as many as several autopoietic interactions to leave the process. At the same time we must not judge those who select themselves out as unethical, but recognize that our own imperfections and lack of understanding of the creative transformation process may have driven them away. We must continue to have compassion and love for persons who cannot overcome their fear. If we had overcome all of our fear we would not have driven them away, if they were in fact ethical. It is always unethical to be certain and ethical to doubt.

We can and should judge individual objective acts by ourselves or others as ethical or unethical. However, we, as human beings, are far too complex to fully understand. We cannot even understand ourselves, let alone others. Therefore we must always be ready to forgive and to love. We judge only acts; we never judge others or ourselves.

The greatest source of fear is that persons judge themselves as unethical. This is extremely destructive to the person and those around him/her. The more ethical we become the more damaging to others are our judgments about their ethics. Therefore, we must follow the teachings of Jesus and learn not to judge others or ourselves. When we judge an act as unethical we should always propose a better alternative—or keep quiet. We must never lose sight of the fact that we may be wrong. At the same time we must take the ethical action dictated by our conscience and then use scientific method to find out if we were mistaken. The more we discover our errors and recognize them, the fewer errors we will make. This is a quantum concept.

There is a network of persons engaged in creative transformation. This network is available to any person or octet who wishes to join it. The only price of membership is the open exchange of ethical information. Each octet is independent of every other octet. Each octet pays for its own expenses and not anybody else's expenses. The octets work together on joint projects only when it is mutually desirable. We begin by exchanging ethical information before we exchange information about other things.

Persons who feel uncomfortable about being in a network not started

by themselves should create their own octets and their own network if they wish. Eventually all such networks will unite in a Moral Society, if they are based on the evolutionary ethic. The current network exists only (1) to help, through education and trade, those who cannot entirely help themselves, and (2) to join with other octets and networks who have lowered their fear sufficiently to love and be loved by others outside their current octets and network. There are only four common agreements in this network: (1) a commitment to the evolutionary ethic, the Eight Ethical Principles, the Game of Life, and the Contract for Creative Transformation; (2) a choice to reject fear as a motivator and to share ethical network information with anyone who fills out and submits an application (Appendix) to join the network; (3) a willingness to invest time and resources to help any persons who wish it, no matter how disturbed and evil they may appear at first, to begin creative transformation so long as they keep to the Contract for Creative Transformation; and (4) the willingness to accept as network members any octets or networks who accept these four points of agreement.

Anyone who has better principles on which to create networks and octets is welcome to do so. We will listen and modify ourselves when it seems right. Any individual or group within the network is free to leave and join other networks or start networks of their own, all in the spirit of the Contract for Creative Transformation. All relationships must be voluntary if they are to be creative.

This system for creative transformation is impossible to control, even by the persons who start it or by any government no matter how tyrannical. Anyone can start a group of eight, in secret if he/she is so inclined. Even in a total police state such as the Soviet Union it is difficult to watch and disrupt every possible grouping of eight persons, since they can meet privately in their living rooms, kitchens, or in parks to creatively transform themselves. Once a critical mass of persons have overcome their fear, they will be impossible to control by any government, no matter how tyrannical. Fear is the only thing that makes persons controllable. Persons who can overcome their fear will eventually transform their society into an ethical, progressive system.

For a society to be progressive it must be based on love and not on fear. The society that will evolve naturally among the octets will be such a society. Each octet will recognize that the most creative thing it can do will be to increase the creativity of others. All the successful octets will eventually offer every person who so wishes the opportunity to be creatively transformed. These octets will naturally evolve toward educational and economic self-sufficiency (see Chapters 6 and 7). This in turn will give all human beings who wish it an opportunity to educate themselves and become self-sufficient. The government-controlled welfare bureaucracies of the current nation-states shall be replaced by unlimited educational and

economic opportunity for all who wish to be creatively transformed. If one network should fail through a developmental error, then other, better networks will arise to take its place. Remember, no quantum process is certain, although the average of many independent trials is predictable.

Both democratic and communistic societies are based on fear. The former is based on the fear of oppression by the strong; the latter on the fear of economic insufficiency for the weak. No combination of these is viable. The society which will evolve naturally from the octets and their networks will overcome the oppression of the strong and the insufficiency of the weak by freeing the creative energies of all who wish to learn, teach, and create to the limits of their capability. Simultaneously, all persons who so wish will be assured of support and sustenance, according to their own nature and inclinations, within a freely chosen network of octets. There will be an octet of their own choosing for everyone. This type of society is neither a capitalistic democracy, a socialist state, a combination of the two, nor any other type of system that has ever existed. It is something new. The closest political approximation to the type of society which will naturally evolve among the octets is a libertarian society.

The Libertarian Perspective

Creative transformation is an ethical and an intellectual process, not a political one. However, it has political implications. The major one is that persons who have overcome fear and are driven solely by the evolutionary ethic and love are not controllable by conventional governmental means and do not need outside government in any way. They are self-governing and autonomous. They become individually self-sufficient and join voluntarily with other octets in projects that require more than eight persons, although almost anything that people need can be produced by an octet—anything from food, energy, and housing to education, health care, and transportation. Space exploration and national defense as well as other worthwhile enterprises may require the cooperation of thousands or even millions of octets. How this might be done is shown in Chapter 7. National defense is one of the few legitimate functions for a national government. Even this could be done best by a network of free octets within a libertarian society.

The important point to remember is that self-sufficiency is a relative concept. Not even powerful nations such as the Soviet Union and the United States are completely self-sufficient. We all need others in order to achieve our maximum potential. But we can only fulfill this need for others, ethically, by voluntary interactions. Trying to force others to give us what we need through democracy or communism leads to the destruction of creativity. Only voluntary transactions through mutual free choice can ever be creative.

Persons following the evolutionary ethic, octets and their members, assume responsibility for their own life and declare their own freedom while respecting the freedom of others. This is the type of behavior that maximizes creativity. Therefore, a corollary of the Eight Ethical Principles is that a person's life and property belong entirely to him or herself and that no one has a right to any part of another person's life or property without his/her consent except in necessary self-defense against the person in question. This is the ethic of libertarianism.

The libertarian ethic says that the liberty of each individual is sacrosanct and that individual liberty cannot be ethically interfered with except in self-defense. The democratic ethic says that that which makes for the greatest liberty for the greatest number is the greatest good. Therefore, under democracy, the individual liberty of some might be restricted in order to provide for the greater liberty of others. A corollary of this is that it is "acceptable" for popular majorities to impose their will on unpopular minorities. This thinking leads inevitably to socialism and the destruction of individual liberty and creativity. The Bill of Rights in the United States was supposed to limit this intuitive contradiction in democratic ideology, but it does so ever less effectively. Eventually, in every democratic society, the liberty of the few is not only sacrificed for the alleged liberty of many, but the liberty of all is sacrificed through socialism for the illusions of material security of the majority.

A libertarian society is one in which anyone can do or say anything he or she wishes so long as he or she does not impose undeserved harm on another. When is harm deserved? Self-defense through force against assailants or robbers is clearly an example of deserved harm inflicted upon another. Speaking any truth which is harmful to another is not an undeserved harm unless it violates a prior contract or is part of an unethical (criminal) conspiracy. Conversely, assault, robbery, slander, libel, lies, pollution of another's space, and breaking agreements are considered wrong because they impose undeserved harm on others. They also decrease their victim's creativity. "Harm" is anything that decreases anyone's creativity.

Ethically, we can never increase our creativity at the cost of someone else's creativity because unethical means can never achieve ethical ends. It is always unethical to decrease the creativity of a single individual, no matter how large the alleged majority that is to benefit from this "sacrifice." This is why communism, democracy, and all combinations of the two lead to self-contradictory, i.e. self-destructive, systems that are leading the human race toward annihilation by reducing our freedom to choose. Only the evolutionary ethic can serve as the basis for irreversible progress. Only libertarianism is politically compatible with the evolutionary ethic.

The Founding Fathers of the United States were libertarians in spirit who made unethical compromises toward democracy and majority rule in order to supposedly succeed. These ranged from a toleration of slavery to

the right of a sufficiently large majority to take away everyone's civil rights (e.g., a 75-percent-majority of the state legislatures to amend the U.S. Constitution). The latter eventually led to inequitable land-use laws, the draft, the income tax, compulsory, destructive educational bureaucracies, and police state bureaucracies—all gross violations of the libertarian ethic. The Founding Fathers' famous dictum, "That government governs best which governs least," is pure libertarianism. Neither they nor the ever more corrupt political bureaucracy that governs the United States lived up to this dictum. Instead we have a government that always governs more and more and constantly takes libertarian rights away. The only positive developments in these matters since the first U.S. Constitution have been the Bill of Rights and related amendments such as the abolition of slavery. Almost every other action of government has diminished liberty.

The creative transformation process will lead automatically and inexorably toward a libertarian society. The creative transformation process will lead to the concentration of the most creative persons in the octets and network of octets. Even when these disagree among themselves about many things, they will agree about the need for a libertarian society because creativity can only be maximized under maximum individual liberty.

Since creativity is the basis of all power and all wealth (see Chapter 7), by simply withdrawing their support from their respective governments and the supporting economic system and by concentrating on their own creativity and their own self-sufficiency, the octets shall automatically create the structure of a libertarian society. They will then band together to protect their own freedom and extend it to others. This will turn the society into a libertarian society where each octet essentially has the rights of a sovereign government, and all political choice is through unanimous consensus.

Each individual could remain unaffiliated, join, or create any group of any size of his/her choice. Individual liberty would always be protected, but only groupings with at least four men and four women would have sovereign rights. This will restrain psychopathic personalities, who typically are loners. Within a creative transformation octet the best of each comes forward while the worst eventually disappears. Anarchy is impractical.

Disputes between octets and individuals would be settled by creative consensus with neutral octets chosen at random to serve as arbitrators or as judges in criminal cases, again by consensus. Majority rule would in general be replaced by consensus among octets. Each octet would have the right not to cooperate with others and to function as an isolated sovereign state. Every octet would do its best to protect everyone's individual libertarian rights, because this would maximize creativity and because it is unethical to tolerate destructiveness. Because of creative competition among groups, it is expected that very large organizations would not compete effectively against the free octets and their networks.

The closer a society's economic system is to *laissez faire* capitalism,

the sooner it will become a libertarian society after the creative transformation process begins. Therefore, we should expect the United States—which, in spite of the fact that it has been moving away from libertarianism since its inception, is still the freest society on earth—to become the first creatively transformed libertarian society. Tyrannical societies, such as the communistic and Islamic states, are the farthest from being libertarian societies. They should take much longer to be ethically transformed. But the creative transformation process will be difficult to stop in the tyrannical societies even with police state terror. Only common fear makes persons controllable for destructive purposes.

The Next Four Steps

In order to optimize the creative transformation process it is the responsibility of each octet and their networks to go beyond the first four steps. They must also take the next four:

Step 5. Become self-sufficient in education, economics, health, defense, and everything else, in this order of priority. Only a fairly large network can become more self-sufficient than a current nation-state.

Step 6. Help other octets, in your own network first and then in other networks, to achieve the same degree of self-sufficiency through education, trade, and mutual defense agreements.

Step 7. Extend the protection of the self-sufficiency networks in the form of a libertarian society to any person who wishes to join it on equitable terms. Doing this will provide security for all human beings who need it and eventually leave the central government without power, wealth, or a creative population to govern. Remember that both security and insecurity are illusions. Only the Game of Life is real. The central government and its willing subjects, if they are not nurtured by creative persons, will consist entirely of parasites and will eventually collapse—to be replaced by a libertarian society. It is unethical to nurture parasites.

Step 8. Extend the process to other countries through education, trade, and mutual defense until the entire world is a creatively transformed libertarian society on the way to becoming a Moral Society. Never impose your way of life on others by force, but allow them space to be different in their own territory. Human intelligence without human ethics leads inevitably to self-destruction [280]. Similarly, you fight to the death to defend your liberty and that of affiliated octets. It is unethical to tolerate destructive behavior, however strong the culprit. Creativity can only grow through liberty, never through force. Every tyranny is worse than anarchy.

That is what our Local Moral Society (LMS) has done to us. We are given free will to be creative or destructive. We are never forced to be creative. Indeed, we can almost always find a short-term advantage in behaving anarchically and destructively, or so it seems. The last four steps are primarily for maximizing our creativity by maximizing our intelligence *after* our ethics have evolved to the point where we can handle a quantum leap in intelligence without self-destructing. Each octet will know when it is ready to begin taking the last four steps. Until then it should concentrate on the ethical and moral aspects of its creative transformation.

We have used the concept of a libertarian society in an idealized fashion to communicate a consequence, but not necessarily a method for achieving the consequence. The libertarian society is not a goal; it is merely the consequence of persons freely engaging in creative transformation. The only goal is to maximize creativity. Just as democracy and communism are means which are not ends and lead to self-destroying contradictions, so would the goal of creating a libertarian society be another means which is not an end. We reject anarchy because it does not maximize creativity.

We see that in the Libertarian party in the United States. This party has a stated goal of creating a libertarian society, as we have defined it. In spite of the fact that the Libertarian party has the allegiance of some of the most creative persons in the United States, along with some of the most hedonistic and selfish, it has already produced a party system which is almost as bureaucratically corrupt as the Democratic and Republican parties, without ever having achieved any significant power! For example, its political candidates are usually no more creative than the Democratic or Republican candidates. The Libertarian party puts almost as much emphasis on legalizing drugs as it does on reducing government. It has no better alternative to the arms race than isolationism and a purely defensive posture. It promotes selfishness rather than love. If the Libertarian party took over the United States government it would have compromised its ideals so much in order to woo the masses that it would be as indistinguishable from the Democratic and Republican parties as they are from each other. The political process in the United States is such that libertarian rhetoric will be used by hypocritical politicians whenever it is politically expedient.

The masses are never wooed by liberty, but only by the promises of more security—another illusion. The love of power always overwhelms the love of ideology. Most people will vote for libertarianism, not out of ethics, but out of the belief that it is in their economic best interests. A necessary but not sufficient condition for any system to keep from total corruption is that no one who seeks power over others in any way is ever granted power.

It is true that power corrupts, and absolute power corrupts absolutely. However, the mere pursuit of power, no matter how noble the purpose, also corrupts as the Libertarian party has shown us. That is why no one who wants power should ever have it. Only the exclusive, open-minded

pursuit of truth through creativity, love, and full scientific feedback from all persons can keep an organization or an individual from becoming corrupt. And even those noble goals and methods will fail if the autonomous organizational unit is much larger or smaller than eight persons or lacks full and equal participation of both men and women.

In order to be maximally creative, the octets need alternatives to the current educational and economic system. Each octet may develop its own alternatives. There is still enough liberty in the United States to create these alternatives and replace the current, destructive educational and economic systems with ethical systems based on love rather than fear.

The next two chapters present some alternatives for your consideration. It is what we wish to do within our octet and within our network. Those who wish to join us in this endeavor are welcome. Those who wish to create their own alternatives have our best wishes. We hope to learn from you. You are welcome to learn all you can from us. We hope you are better and more successful than we are. Then we will follow your lead. The more alternatives that are tried to create an Ethical State, the higher the probability of success. No monolithic organization is necessary or desirable. Eventually we will all rejoin in the Moral Society. The Ethical State is a new phylum of the human mind, which is destined to converge into the Moral Society—just as we are now converging into the Ethical State.

The Ethical State is the state of mind that results from creative transformation. The Ethical State is also any octet or network of octets who have actively engaged in creative transformation. All who value truth more than happiness and all who love more than they fear are living in an Ethical State. It is a state without boundaries. An Ethical State is creative. In order to maximize its creativity, it must continue to become moral and to educate itself in a new way.

CHAPTER 6

An Educational Alternative

We can transform ourselves so that we are moral, totally loving, devoid of fear, and totally creative in all our acts. But that is not enough to maximize creativity. We must also maximize our intelligence, because C = IE. We have two impediments to maximizing intelligence. The first is our own fear, which inhibits our ability to learn and forces us to specialize. The second is negative ethics and their consequent fear and destructiveness in others. All creative persons, if they do not always treat all destructive persons with love, are susceptible to the destructiveness of others. If we increase the intelligence of unethical persons, we merely increase their ability to destroy. Even highly ethical persons, if they are too intelligent and not yet moral, are occasionally destructive; their acts may lead to irreversible entropy for the entire planet. This is part of the cosmic quarantine by the Local Moral Society (LMS). Consider what the highly ethical inventors of nuclear weapons in both the Soviet Union and the United States (as well as other countries) have done. They have done this because they refused to assume full responsibility for the consequences of their actions, absolving themselves of this responsibility by turning over control of those weapon systems to the political bureaucrats of their countries.

By their very nature, political bureaucrats are persons who value power over truth. Persons who, in any way, seek power over others (personal power) should never have it. Those who seek personal power without truth are even less qualified to have it. It is unethical to increase their intelligence. No one should be given control of a weapon that he or she is incapable of creating for him or herself. No one should be taught what he or she cannot discover. That is why we focus first on increasing ethics, then on increasing intelligence. This is a minimum constraint on the destructive spread of intelligence. It is how we should emulate the cosmic quarantine. We maximize intelligence together with ethics. We maximize creativity.

To maximize creativity, an educational system must take into account the relationship between ethics and intelligence. At the same time it must not inhibit the flow of information to ethical persons. A technique for accomplishing all these objectives is to create an educational system based on love in which creative transformation is inextricably interwoven with the increase in intelligence.

Education in secular schools is inevitably separated from any ethical considerations. In seeking to maximize only intelligence, they minimize creativity by specialization and the destruction of ethics through conditioning by fear. Religious schools often corrupt their ethical teachings with dogma and compulsive ritual based on fear, thereby alienating those who are scientifically and creatively oriented. As a result, religious schools tend to produce few scientists and the least creative psychosocial specialists.

In order for an educational system to maximize creativity as opposed to merely increase intelligence, it must have the following characteristics:

1. It must be based solely on the evolutionary ethic.
2. It must emphasize the growth in ethics and love along with the growth in intelligence and give preference to the former over the latter when and if conflicts arise.
3. It must in no way use fear to condition the student.
4. It must encourage love and cooperativeness rather than competitiveness among students.
5. It must at all times provide the opportunity, not the obligation, for the student to generalize in all fields of knowledge, including the arts, rather than specialize in a single field. Conversely, a student must always be free to specialize by choice while being told the consequences of those actions.
6. It must provide objective feedback to the students about how well they are learning without in any way having this feedback serve as reward or punishment. Only the act of learning is a reward. The only punishment is not learning. The objective results are necessary only to avoid self-delusion. The students should learn to find at least as much joy in discovering their mistakes as in discovering their successes.
7. Creative independence of the students should be encouraged and never criticized before the fact, even when it seems obvious that the student's ideas will be wrong. We learn by our mistakes, using objective feedback, which should be given only after the students have tried their innovative ideas. In this way students are encouraged to recreate the knowledge they acquire and to use their creativity. They are taught only what they can create.
8. There should be no educational time constraints whatever on the students; they should move at the pace which is most satisfying to them. Slow students should be free to move at their pace without feeling rushed. Fast students should be free to move at their pace without feeling bogged down by others.

Many of these objectives will be accomplished simultaneously by organizing the students into autopoietic octets of four males and four females who learn as a group and decide by consensus what they should focus on next. Students should join the octet whose pace and inclination of learning is most compatible with their own. Anytime students cannot reach consensus in their octet, or find a better octet for themselves, they may change octets. Students who wish to work individually or in other-sized groups should also be able to do so and encouraged to change their organizational structure to whatever structure is most creative for them. It may be that the available octets are not optimal for all students at all times during their lives. Students should have an opportunity, not an obligation, to work and study in autopoietic octets. The prediction is that those who choose to work in autopoietic octets will maximize their ethics and creativity as well as their intelligence; if not, the Theory of Creative Transformation can be changed. Given this background, we now focus on the curriculum and the educational organization which maximize creativity. It is our intention to make this curriculum and educational organization available to the maximum number of persons, regardless of their economic means.

A Lifetime Curriculum

The curriculum outlined on pages 284–305 is one that can be started by young children and continued into old age without being exhausted. A person wishing to maximize creativity in the shortest possible time would follow the curriculum approximately in the order given; but anyone should be able to take many different paths within this curriculum, including specializing at any time. All students would be counseled on the consequences of their actions, but encouraged to follow their instincts by doing what feels right for them without fear of making a wrong choice.

The objective is to make the totality of human knowledge readily and easily available to as many persons as possible in such a way that, if they wish it, they are constantly maximizing their rate of growth in creativity relative to their present intellectual and ethical potential. In order to do this we plot an optimal course through the curriculum for all octets or other groupings of students and let them modify the courses according to their own personal inclinations. We also make the feedback on their progress and that of other students readily available to them whenever they wish it, but on a private basis so that any particular student's progress is known only to the student and his/her counselors. All other data is in statistical summaries and protects the anonymity of each student.

The expectation is that, under this system, learning and creativity will be seen as among the most joyful of human experiences. Students will learn to play the Game of Life for the joy it brings—without fear of punishment or expectation of extrinsic rewards. If their studies are disassociated

Curriculum Structure
An Overview and Sampling of the Curriculum Outline (pages 284–305)

	Physical		Biological		Psychosocial		Integration	
	Theoretical	**Practical**	**Theoretical**	**Practical**	**Theoretical**	**Practical**	**Theoretical**	**Practical**
Low-Level Examples	The nature of stone	Stone tools are made	The nature of animals and fish	Hunting and fishing are practiced	How persons communicate	Language games are played	Evolutionary ethics at the behavioral level	AT ALL LEVELS practice art, music, plastic arts, humanities, religious myths of each evolutionary level
Medium-Level Examples	Newton's *Opticks*	Telescopes, microscopes of 17th century are made	Human anatomy is studied per 17th century	Valid medical practice per 17th century is applied	Spinoza's *Ethics* is studied	Social organization & government, 17th century	Human history & evolutionary ethics, intermediate	
High-Level Examples	Quantum electrodynamic theory	Lasers and holography	Molecular biology of DNA & proteins	Recombinant DNA and genetic bioengineering	Quantum theory of mind	Creative transformation applied	Evolutionary ethics, advanced	

Use this chart as a quick orientation to the structure of the Lifetime Curriculum, which is outlined in full beginning on page 284. For each of the thirteen levels of study, the Physical and Biological disciplines are set forth on left-hand pages, and corresponding Psychosocial and Integrative disciplines are elaborated on the right-hand pages.

from external reward and punishment and all students are respected for whatever choices they make, the students will optimize the curriculum for themselves. The essential requirements are to have the totality of human knowledge available and accessible at all times without extrinsic rewards or punishments associated with it. This may be done as follows:

We divide the totality of human knowledge into three primary areas, or dimensions, because human beings normally perceive the integrated whole of the cosmos as three distinct types of phenomena. These are the physical, the biological, and the psychosocial. There are many levels of knowledge within each of these dimensions that are normally associated within our archaeological and cultural history. Indeed, what integrates the three dimensions into a whole is the evolutionary perspective (as in the first four chapters) by which we see human history as a continuation of our biological evolution and biological evolution as a continuation of material evolution. Therefore, at each level (see chart, p. 282) the student is presented with the three distinct areas of study—plus a fourth discipline, which is an ethical evolutionary-historical-artistic integration of the first three.

Art integrates knowledge at the unconscious level. The entire program integrates knowledge by having ontogeny recapitulate phylogeny at the psychosocial level. Students learn in an order, context, and manner similar to that in which the human race learned the same material and are given an opportunity to rediscover this knowledge. Everything they learn is always related to everything they know in a meaningful, practical way.

Within each of these four areas there exist side-by-side the theoretical ideas and the practice of these ideas in technology. This gives the overall structure for the curriculum as shown on the facing page.

At each level there is artistic expression in music, literature, plastic arts, dance, humanities, and religious myth that ties all the knowledge together at the unconscious level. Therefore the students have the opportunity to learn and practice the arts appropriate to each level with the technology of that level.

At each level the students are taught by at least one teaching octet that splits the four primary areas of study among them, with one male-female pair team-teaching each of the four areas. A teaching pair is responsible for both the theoretical and the practical studies in each of the four areas. Therefore, each teaching octet must contain at least one male-female pair that is expert in each of the four dimensions: physical, biological, psychosocial, and integrative (ethical, humanistic, artistic). Each male-female team-teaching pair can effectively handle up to 32 students at a time. The day is divided into eight periods of one hour each, with the teachers teaching four periods and spending four periods in counseling, preparation, and personal research. At the lower levels the young students spend a considerable amount of their time in relevant play and, possibly, taking naps, according to the student's wishes. Some of the counseling is reserved for parents

(Text continues on page 306.)

Avg. Level	Avg. Age	Physical		Biological	
		Physical Theory	Physical Practice	Biological Theory	Biological Practice
1.00	3.00	Cause and effect	The lever	The human body	Body care
1.25	3.25	Clubs and poles	Modifying trees and branches	Animal bodies; small domestic mammals	How to care for a pet
1.50	3.50	Different stones and their properties	Using stones	Edible plants and their properties	Gathering edible plants and mushrooms
1.75	3.75	Shaping stone	Building simple stone tools	Edible animals and fish	Hunting and fishing
2.00	4.00	Shaping wood with stone	Use stone tools to modify poles and clubs	Food preparation and preservation	Cleaning and preparing small game and fish using bone, wood, and stone
2.25	4.25	Handling fire	Use of stone & wood to control fire; use of fire to harden spear points	Advanced food preparation	Cooking vegetables, fish, and meat on open fires
2.50	4.50	Advanced fire handling and control combining wood and stone tools, theory and design	Hafted axes and choppers are made; stone fire carriers, simple weaving and knotting of vines & leather	Elementary tanning and use of bone, vines, and vegetable fiber	Skinning animals and fish, preserving leather, advanced cooking, preparing vines and vegetable fiber
2.75	4.75	The bow and fire making	Making bows and starting fires	Advanced food preparation; advanced tanning and bone work	Advanced cooking; clothes from animal hides; use of sinew and thongs; hunting with dogs
3.00	5.00	The use of clay and the bow and arrow; design of simple rafts	Making and baking clay pots on an open fire; making and using simple bows and arrows	Advanced food preparation including drying, smoking, & curing; health care	Cooking, drying, and smoking with clay pots; preparing and using medicinal herbs and poultices
3.25	5.25	Advanced paleolithic stone work of knives and axes; advanced bow making; advanced clay work without wheel; large rafts	Making stone tools to make other stone tools; making advanced bows and arrows; bellows and advanced pottery; building a large raft as a group project	Gathering seeds and planting edible plants; basic first aid	Gardening; preparing soil and cultivation; practice of first aid
3.50	5.50	Neolithic tools; construction of shelters; advanced counting; how to make a small dugout canoe and paddle	Construction of simple neolithic tools; the use of tally marks and stored pebbles; building a small dugout canoe and paddle	The biological need for shelter; building of lean-tos and simple teepees; clothes for extreme cold; simple agriculture	Construction of lean-tos and teepees; more advanced gardening; making bone needles and a parka
3.75	5.75	How to construct advanced neolithic tools to work stone and wood; more advanced counting and Arabic numbers to 10; how to build a large dugout canoe	Building advanced neolithic tools; working wood, simple carpentry, building semi-permanent structures; advanced tallying systems; building a large dugout canoe	How to make boots and moccasins from leather and plant fiber; how to know when to plant and when to harvest; taking care of goats and sheep	Construction of complete wardrobes of leather, plant, and animal fiber; more advanced gardening and animal husbandry

Avg. Level	Avg. Age	Psychosocial		Integration	
		Psychosocial Theory	Psychosocial Practice	Integrative Theory	Integrative Practice
1.00	3.00	How to communicate	Exchange of information	Ethics of personal obligation	Free-form drawing and painting, simple songs
1.25	3.25	Verification of information	Repeat same message from different source	Truth and lying, paleolithic stories	Free-form drawing and painting, paleolithic stories, drums
1.50	3.50	Games of information	Teams for sending and receiving messages	Advantages of cooperating vs competing; paleolithic stories	Songs, dancing, drawing, painting, telling stories
1.75	3.75	Making pictures for information communication	Drawing picture stories	Obligations of making oneself understood	Free-form art, stick-figure drawing for stories
2.00	4.00	Advanced picture stories	Making up stories with pictures	Ethics of separating fact from fiction; paleolithic stories	Wood carving and free-form painting; paleolithic stories created and drawn
2.25	4.25	Picture symbols which stand for complex events	Team communications games and "charades" using picture symbols	The difference between a symbol and the thing it symbolizes; paleolithic stories	Charcoal drawing on bark and stone; universal religious symbols; creating stories
2.50	4.50	Advanced picture symbols and counting	Making up stories by stringing together picture symbols which everyone can understand	Creation myths of paleolithic people	Making up creation myths and testing them
2.75	4.75	Rebus writing combined with picture writing	Making up stories with rebus and picture writing	Advanced creation myths of Native Americans and some religious beliefs, symbols	Native American art and what it expresses; free-form art for what students value
3.00	5.00	The notion of an alphabet and sound symbols	Stringing sound symbols together to make a word	The religions of native Americans and the evolutionary ethic	Percussion instruments, music, carving, dance, and art to express religious feelings
3.25	5.25	Reading advanced paleolithic stories with evolutionary ethical theme	Writing simple stories and accounts using alphabet, rebus writing, or pictures as desired	The importance of separating truth from fiction in our writing to avoid misleading others	Late paleolithic art and religion; student's expression of his own feelings about them
3.50	5.50	Reading stories and history of early neolithic life with evolutionary ethics theme	More writing of stories and accounts using alphabet, rebus writing, and pictures as desired	Simple analysis of neolithic culture and religions in light of the evolutionary ethic	Neolithic art and stone carving; clay figurines; self-expression of students
3.75	5.75	Reading more complex stories of neolithic life about religion and creativity in ancient Jericho and Mesopotamia	More writing of stories and accounts using alphabet and rebus writing, but no pictures, show difficulty of communicating numerical concepts over 10	Analysis of why neolithic culture advanced so slowly before the beginning of Sumer; the energy that went into religious ritual & the corrupt priestly bureaucracy	The flute and harp and the neolithic music possible for them; advanced neolithic art and religion; self-expression in all art media

Avg. Level	Avg. Age	Physical		Biological	
		Physical Theory	Physical Practice	Biological Theory	Biological Practice
4.00	6.00	The concept of the wheel; smelting metal from ore; making a simple calendar from astronomical observations; counting and use of Arabic numbers to 1,000 for calendar making, time-keeping, and other uses	Making a potter's wheel and using it; making an advanced bellows driven by a pedaled wheel to heat a charcoal, earth, and clay oven; making a spinning wheel, a sundial, a simple loom	Advanced gardening; the making of cloth from plant and animal fiber; advanced care and management of sheep and goats; gourmet cooking with spices and herbs using ovens; making more advanced permanent shelters of wood and stone	Spinning fiber; simple weaving of cloth with no loom; wheat and corn cultivation; making bread with & without yeast; breeding sheep and goats with seasons; training dogs; constructing small stone and wood huts
4.25	6.25	More advanced metallurgy; the saw and how to use it; how to cast bronze tools, nails, the chisel, and metal hammer; advanced use of wheels; simple arithmetic; adding and subtraction with Arabic numbers; simple geometry	Construction of wheeled push carts; construct bronze tools and show how inferior they are to steel tools; use steel tools in all construction; use pick and shovel and push cart to build small irrigation system and buildings; show how arithmetic and simple geometry help construct these projects	Group design of large irrigated garden, suitable for self-sufficiency of 16 persons; advanced looms and weaving; advanced animal husbandry and selective breeding of sheep and goats; care of chickens and cattle	Construct and plant garden; advanced cooking and preserving of food; fermentation to produce alcohol, distillation of alcohol with copper still
4.50	6.50	Advanced bronze-based metallurgy and smelting of other similar metals; identify related ores and other rocks; simple glass technology; building an oxcart from wood, leather, and bronze; simple multiplication with Arabic numbers; more simple geometry, right triangles, and the circle; advanced calendar-making & time-keeping; how to make a simple boat with sail and oars	Smelt and cast advanced bronzes and similar metals; make and cast glass sheets; make mirrors of metal and glass; build an oxcart; show how arithmetic and geometry are useful; use detailed astronomical observations to make a better calendar, and show how arithmetic and geometry help; build a small sailing and rowing boat	Show how to use a simple plow and fertilizer to prepare land; show how to make fertilizer from minerals and organic substances; show how to cross-pollinate and hybridize plants and trees; show how to use advanced fermentation techniques to produce wine and alcohol; discuss effects of alcohol as preservative and drug; storage and preservation of grain	Advanced agriculture and gardening projects; make fertilizers, crossbreed and hybridize plants; grow grain and grapes; ferment to alcohol, distill alcohol, use alcohol as fuel and preservative, use as disinfectant; cultivation of yeasts, and advanced baking
4.75	6.75	More advanced arithmetic and geometry, division of numbers, simple fractions; creation of more advanced sailing craft, the ideas behind a horse-drawn war chariot, the compound bow with metal-tipped arrows, how to construct the two-person war chariot and its relationship to the oxcart; the Babylonian abacus theory	Show how arithmetic and geometry contribute to following technologies built by groups; build a more advanced sailing craft; build a war chariot using steel, wood, and leather; show how much more difficult it was with only bronze; build compound bow with bronze-tipped arrows; practice with bow until expert, and practice with war chariot	Domestication and use of the horse as a biological machine, special care and breeding required by horse, horse behavior and anatomy, equipment for controlling horse and how to make it	Horse training and use for farming and pulling chariots, speed comparisons, training horse for chariots and bareback riding

Avg. Level	Avg. Age	Psychosocial		Integration	
		Psychosocial Theory	Psychosocial Practice	Integrative Theory	Integrative Practice
4.00	6.00	Reading stories in personal terms about the possible prehistory of the Sumerian people; vocabulary development and the practical use of grammar	Write stories of fiction and personal activity using only alphabet; show how convenient it is to know when a sentence starts and ends, and how punctuation prevents misunderstanding	The ethics of larger groups; how it is possible for several octets to cooperate if they have common rules and objectives; how ancient civilizations were slave-based and ruled by priestly bureaucracies	Students construct rules and goals of cooperative behavior in order to build large-scale projects, buildings, irrigation systems to benefit hundreds of persons
4.25	6.25	Realistic but fictionalized history of the founding of Sumer and how Sumerians created their culture up to the time of the invention of writing; show how the religion and its ritual became overwhelmingly important, and how by controlling food the priests controlled people, warriors, and kings	Write stories of fiction and personal activity; write essays on behavioral ethics; use proper punctuation for clarity of ideas and teach correct punctuation for students; have students ethically analyze in writing the history of Sumer and show what might be wrong	The ethics of individual rights; show that taking rights away from individuals for a larger group damages the group it is supposed to help; show how creativity is important to progress and how liberty is important for creativity	Students study Sumerian art and try to express their own feeling about Sumer in ceramic figurines similar to the Sumerians; stone sculpture project; reproduction of Sumerian relics and artifacts
4.50	6.50	Read a simple nonfictional history of Sumer, show their writing and accounting systems and note their defects; show how clay as prime resource led to cuneiform; endurance of clay records; read full accounts of Sumerian myths, including Garden of Eden; Gilgamesh, and Noah	Write an analysis of Sumerians' history and their collapse; write an analysis of their myths and what they mean; write your own myths to communicate the same ideas as the Sumerian myths; write a creative story of your own choosing	Ethical analysis of the rise and fall of Sumer, the ethical nature of the conquerors of Sumer, their strengths and weaknesses, the weakness of theocracy and hereditary aristocracy, why these entropic systems went on for so long	Creative synthesis; high Sumerian art compared to art of conquerors; artistic group project to communicate the rise and fall of Sumer through music, painting, sculpture, and dance
4.75	6.75	Read a simple world history of the Ecumene from the fall of Sumer to 600 BC; show how little progress and creativity there was until then; show how Aryans spread Sumerian civilization to the entire old world and possibly to the Americas; read literary examples of each major culture	Write an ethical analysis of each major culture and why they could not significantly improve on Sumerian civilization; write an analysis and interpretation of their literary works; write your own story to express what you feel about this period of history	An ethical analysis of the Sumerian religion and those that followed; show how ethical vitality in primitive cultures can lead to conquest of more advanced civilizations; show how religions that seek reward for ethical behavior are destructive; show how it was necessary to invent morality	The art forms of Babylon, Egypt, Crete, pre-Confucianist China, and India; make your own version of these art styles; improvise music on the instruments of these times; do a group art project on this period of history

Avg. Level	Avg. Age	Physical		Biological	
		Physical Theory	Physical Practice	Biological Theory	Biological Practice
5.00	7.00	The smelting of iron and simple steels, forging iron and blacksmithing; simple astronomy and navigation, advanced sailing ships that might have crossed the Atlantic; the iron forging necessary for controlling a horse in battle; pre-Greek geometry and arithmetic using Arabic numbers, advanced theory of the Babylonian abacus	Smelt ore, forge from iron a complete set of tack for a horse, plus horseshoes; forge and make iron sword and spear; make large clay jars for storing grain, oils, and wine; begin one-year sailing ship construction project for group; show how geometry and arithmetic help in the above projects, build a Babylonian abacus	Advanced study of equestrianship for war, shooting a compound bow while riding horseback, the use of the lance and the sword from horseback; mammalian reproduction in detail, nursing and care of young mammals; processing milk into cheese and yogurt	Horse handling, training, and riding; grooming and care of horses, shodding and equipping the horse, the use of different bits, saddles, and stirrups; mammalian reproduction and breeding; comparisons of dogs, cats, sheep, goats, cows, and horses; cheese and yogurt from cow's milk; extract oil from fruits and nuts; make and store wine; optimal physical training of the human body
5.25	7.25	Continue with projects begun previous quarter	Continue with projects begun previous quarter	Continue with projects begun previous quarter	Continue with projects begun previous quarter
5.50	7.50	Advanced metallurgy, casting bronze sculptures through lost wax process; making of hard steel alloys, nails, bolts, and screws; making advanced presses and catapults; fractions and decimals, empirical basis of Pythagorean Theorem, right triangles, circles, spheres, and parallelopipeds	Continue work on sailing ship, do precision bronze castings; make knives using hard steel alloys; make nails, bolts, screws, presses, and catapults; show applications of mathematics and geometry to the above	Human reproduction, comparative male and female anatomy, hormonal cycles, fertility cycles, puberty and emotions, lactation and nursing, care of infants, normal patterns of growth for young boys and girls	Advanced breeding of animals and plants, extraction of fats and oils from vegetables, fruits, and seeds; extract animal fats from carcasses and meat; work in nursery caring for small children 1–2 years old
5.75	7.75	The geometry and mathematics of Pythagoras, several proofs of his theorem, the Pythagorean solids, the harmonics of vibrating strings and the physical basis of music; geometry applied to navigation, astronomy, building and surveying; the technology of glass, glass blowing	Construct the Pythagorean solids, use several approaches to making dodecahedron and icosahedron; construct navigational computer, advanced abacus; construct glass bottles, mirrors, parabolic mirror; finish sailing ship	Human health and the Greek medical tradition, Aesculapius and Hippocrates; a healthy mind in a healthy body; physical culture and optimal health; diet, exercise, and health	Gardening and preparation of food for optimal health, an exercise plan for lifetime health, strength, and energy; construction of a glass still; care of young infants

Avg. Level	Avg. Age	Psychosocial		Integration	
		Psychosocial Theory	Psychosocial Practice	Integrative Theory	Integrative Practice
5.00	7.00	The story of Zarathustra; how he changed the Persian people and how they went on to create the world's greatest empire until conquered by Alexander; the Zoroastrian religion and myths in detail	Analysis of ancient Persian history and religion; write a story of how Persian history might have been different if the religion had been different	Ethical analysis of Zoroastrian religion and ethical system, strengths and weaknesses, and how it was doomed to failure	Ancient Persian art, architecture, music; analyze and reproduce style according to your own feeling about this culture; do a group project expressing ancient Persian civilization
5.25	7.25	The story of Confucius and his teachings and how they changed China; the books of Confucius are read, discussed, and compared to the philosophy of Lao Tse; the interaction of Taoism and Confucianism in Chinese history is discussed	Written analysis of each of the books of Confucius and stories about Confucius; an analysis about Lao Tse; writing of imaginative stories about life in China; essay on how you personally feel about Confucius and Lao Tse	Ethical analysis of Confucianism and Taoism as ethical systems, as ways to knowledge, and the civilization they produced; what was right and what was wrong and predictions	Ancient Chinese art to Tang dynasty, analyze and reproduce style in sculpture, painting, and music; use Chinese style to express your feelings about classical Chinese culture in group art project
5.50	7.50	The story of Buddha and his teachings and how they changed India and the East; emphasize the basic ethical nature of Buddhism and its tolerant compassion toward others; show how Buddhists became psychosocial specialists and stopped innovating in the natural world; compare to Hinduism	Write essays on the meaning of Hinduism and Buddhism and how they relate to you; how Buddhism and Hinduism relate to each other, how you would feel and act if you were suddenly put into a Buddhist or Hindu society; give evidence for and against reincarnation, what impact these societies have on the world, predictions	Hinduism and Buddhism in light of the evolutionary ethic and the eight Ethical Principles; the historical impact and consequences of those religions; the ethics of the caste system; why Buddhism is more successful as an export; common Aryan origins of Hinduism, Buddhism and Zoroastrianism	Experience directly Buddhist and Hindu meditation and its comparison to autopoiesis; Buddhist and Hindu art; draw mandalas of your own, sculpt in Buddhist and Hindu style, make up mandalas, learn to play Buddhist and Hindu music; perform dances, do art works expressing how you feel about Buddhism and/or Hinduism
5.75	7.75	Early Greek history to Thales; the *Iliad* and the *Odyssey*; the story of Thales and Pythagoras and how they laid part of the foundations of Western civilization; the rational and mystical as reflected in those two men; Thales and ethics; Pythagoras and religion	Write an essay on the ethics of the characters in the *Iliad* and *Odyssey*, the ethics of the mythical characters and gods, the attitudes toward women and their role in Greece; make up a Greek-style myth of your own	The warlike Aryan tradition and how it led to Greek culture, the obsession with domination and personal freedom, the oppressiveness of a slave-based culture, the extreme military specialization of Sparta; why a love of truth and intelligence is not enough if there is no love for others	Geometric art using Pythagorean and Greek principles, composition of music using Pythagorean theory of harmonic scales; begin a sculpture project in the Greek style; Greek music and dances including those of Sparta

Avg. Level	Avg. Age	Physical		Biological	
		Physical Theory	Physical Practice	Biological Theory	Biological Practice
6.00	8.00	The geometry of Euclid using modern algebraic notation, introduction to algebra as it applies to geometry, use of geometry and vectors to sail against the wind; give many examples of the practical applications of geometry in many fields; the Atomic Theory of matter of Democritus; other Greek theories of water, earth, air, and fire	Use geometry to calculate size of the earth, distance to the sun, size of the sun; use geometry to construct and use a large catapult; build a bridge by geometric design; work with glass making lenses and mirrors; begin design of ship that can sail against the wind; practice sailing the ship built last year	Internal anatomy of vertebrates, fish, frog, rat, and pig; the true role of each organ and what Aristotle and Galen thought they were for; Greek theories of evolution compared to modern theory; point out how dangerous it is for authorities to be wrong; the value of doubt	Dissection of fish, frog, rat, and pig; identification of all major organs and bones; practice in meat processing, packaging, and preservation without refrigeration; continue practice in caring for young infants in first year
6.25	8.25	Continue the previous work and continue with the geometry and science of Archimedes; use modern algebraic notation and point out how difficult the work of Archimedes was because of notation; theory of pullies and parabolic mirrors; show how abacus gives answers to the notational problem	Construct a system of pulleys and a block and tackle; construct parabolic mirrors to collect solar energy by heating water, and work out schedule for how mirrors should be aligned as function of time of year and day; finish design of ship	Detailed survey of Greco-Roman medicine and the modern versions of these beliefs; the complete guide to the use of herbs and medicines for curing and preventing illnesses; taxonomy of herbs; review Greco-Roman theories of biology	Plant a garden of medicinal herbs, take field trips to collect medicinal herbs, prepare poultices and medicines as have been verified by time and modern usage
6.50	8.50	The works of Archimedes continued, the school of Alexandria, and the continuation of Greek mathematics, science, and technology; full development of algebra and trigonometry using modern notation; solid geometry and trigonometry, applications to navigation, the construction of lenses	The design and construction of water pumps, the design and construction of steam turbines; practical lens making continued; begin modification of ship made in fifth year to sail against the wind; glass blowing continued	Study of preventive medicine; germ theory of infection and how hygiene can prevent it (although Greeks had lenses, no one discovered germs for 2000 years), parasites and their life cycles, the danger of eating meat, the importance of cooking and cleanliness	Use lenses to study small organisms, examine parasites in intestines of animals, show how maggots hatch from fly's eggs; basic entomology observed; use microscope to study basic parasitology
6.75	8.75	Continuation of the study of the science, technology, and mathematics of the School of Alexandria	Continuation of the above; make crude telescope and microscopes	The study of microscopic life; how lack of scientific method inhibited medical practice for 2000 years; how to prevent the spread of disease; viruses as submicroscopic organisms not to be discovered for 2000 years	Study of amoebas and major human parasites; animals as sources of infection for humans; the parasitic worms

Avg. Level	Avg. Age	Psychosocial: Psychosocial Theory	Psychosocial: Psychosocial Practice	Integration: Integrative Theory	Integration: Integrative Practice
6.00	8.00	Greek history from Thales to the Roman conquest, the *Dialogues* of Plato, a survey of Aristotle, a survey of the Greek plays and the fables of Aesop, the ethical teaching of Socrates, the Macedonian interlude and Alexander	Perform one play by Sophocles and one by Euripides; write a critique of Greek culture and why it failed; write a critique on Socrates' life and on whether Socrates should have drunk the hemlock; write an epic poem on Greece	Ethical analysis of the teachings of Socrates, Plato, and Aristotle; show how the lack of love and the will to power forced Greece to destroy itself; consider that the great thinkers of Greece never had power nor were they free of tyrants except at first	Write a play in the Greek style on Greek themes, critique one another's plays, finish sculpture in the Greek style, do a group art project on the meaning of Greece
6.25	8.25	Greco-Roman history from the start of Rome to the time of Jesus; analysis of the works of Lucretius; what the Romans had of their own and what they learned from the Greeks; Roman ethics and theories of government; how tyranny can always replace a democracy by promising to take from the rich and give to the poor	Learn Greek and Latin roots to English and scientific and technical terms, emphasis on nouns; the Greek alphabet, brief survey of Greek and Roman grammar and its complexity; show how English grammar is simpler, more practical; show how as vocabulary expands grammar can be simplified; write essay comparing Greek and Roman culture	Sexual ethics and how the Greeks and Romans related to them; pleasure as an end in itself; the exploitation of women, exclusion of women from all important decision making, women as sexual objects, the absolute authority of the father; Roman law and evolutionary ethics, subservience to the state and ethical principles	Design a domed and vaulted building made of wood and masonry, calculate stresses, and show the use of the arch and dome; play Roman music and practice sports, do a group art project on the meaning of Rome under Augustus
6.50	8.50	The history of the Jews; read all of the *Old Testament*, the ethical principles derivable from the *Old Testament*, the mixing of ethics, techniques, and ritual; the Jewish interaction with the Aryans after the Babylonian captivity, the resistance to Hellenization, the conquest by Rome, the Jewish bureaucracy, sampling of the *Talmud*	Essay analyzing *Old Testament* as a historical account and as a myth; compare to *Iliad* and *Odyssey;* Jewish laws are analyzed in terms of their ethical value and their political implication; essay on Judaism as an ethical system	Ethical analysis of the *Old Testament*, personal ethics, health implications of many of the Jewish laws; show how the means became the ends and how ritual destroys ethics; the destructiveness of becoming specialized in one's own religion	Jewish abstract art in the form of the Menorah and the Star of David; paint an art work using Jewish symbols to express a Jewish theme without including the human form or animals; Jewish music and Passover songs
6.75	8.75	The *New Testament* and the life of Jesus, the ethical teaching of Jesus, Jesus as a Jewish reformer and rabbi, the deification of Jesus, the teachings of Jesus in relationship to the Greco-Roman religion, St. Paul and Christianity as a synthesis of Judaism, Jesus, and Greco-Roman religion and philosophy	Write an essay on Jesus and the meaning of his life and death, essay on the criticisms of Jesus against traditions and the Jewish bureaucracy, essay on whether Jesus could have studied in India and/or Tibet, essay on Jesus' teaching and the school of Alexandria	Ethical analysis of the *New Testament*, the high ethical content in the teachings of Jesus compared to their corruption by St. Paul, the mythification & deification of Jesus in the Roman tradition by those who did not know him, analysis of synoptic gospels showing how they were all derived from a simpler, common source	Draw and paint art showing the unification of Judaism, the teachings of Jesus, and the Greco-Roman religion (Michelangelo's Sistine Chapel is best model); write a poem expressing this synthesis; do a group art project expressing the essence of Christianity

Avg. Level	Avg. Age	Physical		Biological	
		Physical Theory	Physical Practice	Biological Theory	Biological Practice
7.00	9.00	Consolidation of Greek mathematics and geometry using modern notation; practical chemistry in purifying common elements from their ores and making chemical compounds such as sulphuric acid, nitric acid, hydrochloric acid, aqua regia, and gun powder	Use geometry and mathematics to design a cathedral using Roman arches, vaults, and buttresses; isolate elements from their ores; make acids and simple compounds, gun powder, and paints; make mortars and cements; continue modification of sailing ship	Further study of microscopic life, protozoa, mites, worms, and other microorganisms that live on and in mammals; diseases they cause and symbiosis they provide	Microscopic observation of microorganisms, classification in modern terms; observe sea plankton, sponges, and hydra, and observation of their life cycles
7.25	9.25	Mathematical modeling of nature through advanced algebra, geometry, and trigonometry; derive solutions to quadratic and cubic equations; advanced navigation, the compass and the theory of the sextant; advanced geometry, trigonometry of arches, domes and vaults	Masonry work, making stone arches & vaults; begin construction of small wooden house with some masonry; continue to work with lenses and practical optics, make large reflecting telescope, make better microscope; make additional chemical compounds, acids and paints, dyes and cements; construction of an astrolabe; practical astronomy; finish modifications on sailing ship	Animal systematics, invertebrate zoology, comparative organ systems, organ structure and function, cell theory of animal structures	Laboratory dissection and study of the invertebrate phyla in an evolutionary context; detailed experimentation for function of organ systems and microhistology
7.50	9.50	Mathematical modeling of nature continued; quartic equations; heliocentric model of solar system compared to Ptolemaic; comparison of Viking ships as fast raiders to more seaworthy sailing ships; prepare for two-week ocean trip, theory of alchemy	Continue work with wood and masonry in house; begin construction of accurate water and weighted clock; begin construction of astronomical telescope with instruments; alchemical preparation for isolating elements and making compounds; the alchemical symbols as archetypes	Continue classification of invertebrates for all remaining major phyla, specifying organ functions and histology; show how all metazoa have same types of cells and all start as single cell, simple embryo egg	Laboratory dissection and microscopic observation of major invertebrate phyla; tissue and embryology; transition species to vertebrates, tunicates, and amphioxus
7.75	9.75	Begin study of conics and analytical geometry; begin study of the dynamics of falling bodies and the pendulum; continue study of alchemy, showing how acceptance of wrong hypotheses impeded progress; consider measurements of time, temperature, and position	Finish wooden house; using telescope and clocks, begin observations of movements of planets and earth relative to sun, and deduce Kepler's laws; take a two-week ocean trip; begin construction of sextant	Continue classification of invertebrates; compare with anatomy of simpler vertebrates; study all organs and their physiology and function; identify cells common to vertebrates and invertebrates	Microscopic observations and dissection of simple vertebrates and their organs; observation of simple embryology and comparison to invertebrate embryology; full dissection of shark

Avg. Level	Avg. Age	Psychosocial		Integration	
		Psychosocial Theory	Psychosocial Practice	Integrative Theory	Integrative Practice
7.00	9.00	The Roman Empire and its interaction with Christianity, the Greco-Roman disdain for manual labor, the Christian disdain for the natural world, the Gnostic Christians, the stagnation and disintegration of the Roman Empire until the rise of Islam	Write speculative essay on how Roman Empire might have endured and what the world would be like if it had; write speculative essay on how Christianity would have developed if the Gnostics had not been persecuted	The ethical decay of Rome; Roman bureaucracy; how the Catholic bureaucracy established itself; Catholic intolerance of deviant views; persecution of heretics; inferiority complex about pagan knowledge; the destruction of Alexandrian library; Hypatia	Finish design of cathedral; paint Christian symbols that express what is best in Christianity; sing Gregorian chants in Latin after studying translations; do an art project expressing the meaning of the Catholic church
7.25	9.25	The rise of Islam; read the Koran; early history of Arabia to 7th century; relationship of Islam to Zoroastrianism, Judaism, Christianity, and the surrounding cultures; the political vacuum in the Middle East	Essay on why so many Jews rejected Islam; essay on why Islam was able to grow and expand so rapidly; essay on the ethical contradictions within Islam compared to Judaism and Christianity	Islam as a closed system; how Islam induces fanaticism; its comparison to Christianity; why Christianity is more open in spite of church bureaucracy; Islam and creativity; the reason for Islam declining as Christianity rose	Islamic abstract art; how lack of representational art diminishes creativity; draw abstract designs in the Islamic style; Islamic mandalas; paint representational art of Islam; compare to Persian and Mogul art forms
7.50	9.50	The great theologians, St. Augustine, St. Gregory, Averroes, Avicena, Maimonides, St. Anselm, Abelard; show their depth and breadth of vision; the weakness of having orthodoxy to defend; the Holy Roman Empire and its relationship to Islam, India, and China; Charlemagne and his successors	Essays on the "proofs" of the existence of God and the ontological arguments; essay on the humanizing role of the Church while it bureaucratically decayed; essay on priestly celibacy and its implications; write your own ideas about God	The dominance of ideology and bureaucracy over ethics and truth, the preservation and distortion of the teachings of Jesus, the fundamental power of the teachings of Jesus in spite of the negative elements	Compare Byzantine with Western religious art and paint a synthesis of the two; paint a synthesis of Christian, Chinese, Hindu, and Muslim art of the period; begin study of the organ
7.75	9.75	St. Thomas Aquinas and the rise of the Holy Roman Empire; the feedback produced by the great schism; the decline of Byzantium relative to the newly emerging West; Roger Bacon and the rise of science; the apparent cultural superiority of Islam, India, China, and Byzantium	Write essay on the theology of St. Thomas Aquinas, indicating the holes in his arguments; essay on Thomistic ethics; the schism analyzed in theological and bureaucratic terms, why schism was so important to Western progress	The relationship of rational theology to mathematics; the church as an arbiter of power between barbarian states; the moral authority of the church in a world of brute force; the cathedral as the synthesis of Western technology, art, and religion	Study and do detailed drawings of major cathedrals; plan to implement construction of cathedral design; begin construction on 1/10 scale model in stone

Avg. Level	Avg. Age	Physical		Biological	
		Physical Theory	Physical Practice	Biological Theory	Biological Practice
8.00	10.00	Continue with study of analytical geometry; begin solid analytical geometry using Cartesian notation; study the design of clocks, thermometers, and astronomical instruments; a study of Kepler and his ideas about nature and the music of the spheres	Continue with mini-cathedral building project; build full-fledged observatory with telescopes, but in spirit of Tycho Brahe make observations to deduce Kepler's laws; take two-week ocean voyage on sailing ship; discuss how Europe extended itself throughout the world in the 16th century	Continue vertebrate comparative anatomy through higher mammals and relate to human anatomy; show how embryology of all vertebrates overlaps at stages; relate to Greek evolutionary theories	Dissect and study vertebrate anatomy, tissues, and organs; go through modern systematics for all major mammalian orders; study embryology of related groups with microscope; the fetal pig and its full dissection
8.25	10.25	The early basis of the scientific revolution, Francis Bacon's *Novum Organum,* Boyle's studies, Galileo, the inventions of Leonardo da Vinci, the notion of experimental "proof"; finish analytical geometry and learn elementary calculus of variations, the concept of limit, and early concepts of calculus to explain Kepler's laws	Continue observation project, build improved clocks, finish sextant, finish mini-cathedral, study map making and various forms of map projections; set up experiments to test Boyle's laws, simple gas laws, experiments to test circulation of the blood	Human anatomy in detail; all organs, tissues and bones, gross structure of the brain; embryology using the fetal pig; use anatomical drawings of da Vinci and Vesalius, plus *Gray's Anatomy*; these integrated studies will last a year	Dissect human cadavers, male and female; observe tissues, and relate to other mammals; show similarity of all organs for all mammals; note how different human brain is
8.50	10.50	The Newtonian synthesis; full study using modern notation of *Principia Mathematica* and the *Opticks*; derive Newton's laws from Kepler's observations; derive calculus from the need to mathematically describe the laws of motion and gravity	Begin making windmill and waterwheel; predict the orbits of the planets using Newton's laws and a few astronomical observations; predict the eclipses of the sun by the moon at different spots of interest on the earth; repeat Newton's experiments showing that light is a system of particles, and that white light contains the spectrum	Continue studies of human anatomy and embryology	Continue anatomical dissection and microscopic studies; learn micro-techniques and make your own slides
8.75	10.75	Derive the calculus up to the use of simple differential equations; derive the formulas for optics and the creation of compound lenses; compare Newton's and Leibnitz' approach	Continue work on windmill and waterwheel; build a Newtonian reflecting telescope; built a chromatically-corrected set of compound lenses for the telescope already constructed; make an improved microscope	Continue studies of human anatomy	Continue work of previous quarter

Avg. Level	Avg. Age	Psychosocial: Psychosocial Theory	Psychosocial: Psychosocial Practice	Integration: Integrative Theory	Integration: Integrative Practice
8.00	10.00	The rise of humanism leading to the Renaissance and the Reformation; the writings of Erasmus, Luther, and Calvin; the Council of Trent and the rise of the Jesuit order; Giordano Bruno, the philosophy of Descartes, and a review of his contemporaries	Essay on the ethical implications of the Reformation; were the Protestants any less bureaucratic? mutual discussion of essays among the octets; essay on the ethical implications of the scientific method and the new philosophy	The literary synthesis, Dante's *Divina Comedia*, Cervantes' *Don Quixote*, Marlowe's *Dr. Faustus*; the music of Monteverde and Palestrina; the art of Bosch, Leonardo da Vinci, and Michelangelo	Write an epic poem about the Christian view of Hell; write a play about a modern Don Quixote; continue study of organ and harpsichord; compose and perform music in the style of Monteverde and Palestrina
8.25	10.25	Hobbes, Montaigne, and Spinoza; read Spinoza's *Ethics* without analyzing proofs and note how this is a huge leap over the philosophy of Descartes and is the first totally rational treatment of ethics in history	Apply Spinoza's ethics to solving problems in practical ethics, politics, and religion; relate Spinoza's ethics to Christianity, Islam, and Judaism; apply Spinoza's model to formulating a model of the universe and evolution; write an essay on the meaning of Spinoza	The literary synthesis continues; read critically Shakespeare's *Romeo and Juliet*, *Othello*, and *Hamlet*; study the music of Handel; study advanced musical theory and composition	Continue study of organ and harpsichord; build a harpsichord as a group project; write a last act to *Hamlet* in which Hamlet lives; play the music of Handel
8.50	10.50	The philosophical contemporaries of Spinoza, Leibnitz, Locke, and Hume on improving the understanding; world history from 1000 AD to 1775	Essay on the hostility to Spinoza; an ethical analysis of the lives of Spinoza and Leibnitz; essay on why Europe embraced the scientific method and modern philosophy while the rest of the world did not	Spinoza's ethics, Christianity, Judaism, and respect for human rights; the rise of democratic ideology; Islam becomes totally entropic; conservative belief systems in the rest of the world; European predation	Group project to perform St. Matthew or St. John *Passion* of Bach; all learn to play the *Musical Offering*, the *Art of the Fugue*, in an octet; each octet does its own orchestration for the *Art of the Fugue*
8.75	10.75	Human rights and 18th century philosophy; Voltaire, Rousseau, Diderot, and the Encyclopedists; the American Revolution; the philosophy and writings of Thomas Jefferson, the social contract, and the Federalist Papers	Essay on Rousseau and irrationalism; essay on the libertarian ideal and the democratic compromise; essay on the U.S. founding fathers allowing slavery to continue—was losing the revolution and hanging a better alternative? Write scenario on what would have happened if there had not been tolerance of slavery	The artistic synthesis continues; further study of the *Art of the Fugue* and the music of Mozart; the pessimistic writings of Jonathan Swift, a tragic interpretation of the democratic experiment	Compose and perform a conclusion to the *Art of the Fugue*; perform as a group project one Mozart opera of students' choice

Avg. Level	Avg. Age	Physical		Biological	
		Physical Theory	Physical Practice	Biological Theory	Biological Practice
9.00	11.00	Begin advanced calculus and partial differential equations; detailed study of the work of Lagrange and Euler, the calculus of variations from Newton to Lagrange, elementary probability theory from Pascal to Cauchy and LaPlace; applications in optics, astronomy, theory of heat	Begin construction of simple steam engine, making from scratch, doing all machining of parts by treddle-driven lathes and water and windmill power; check the detailed mathematical models against astronomical observations	Conclusion of the study of human anatomy and embryology	Conclusion of dissections and microscopic observations; the general functioning of the human body has been observed
9.25	11.25	Continue work of previous quarter; detailed theory of steam engine, the work of Lavoisier, Priestley, and Dalton	Continue above project, switching to electrical machinery; do early experiments in electricity by Gauss, Coulomb, Ampère, and Volta; the atomic model of chemistry and experiments	Begin study of animal physiology and describe biochemistry through mid 19th century; repeat experiments of Helmholtz in biophysics	Experiments in basic physiology showing how human body consumes oxygen and produces carbon dioxide; human body as a heat engine
9.50	11.50	Continue work in chemistry; the work of LaPlace and Carnot, the laws of thermodynamics, the experiments of Faraday; advanced studies in partial differential equations; wave mechanics in optics; begin study of the works of Gauss	Continue chemistry experiments; finish work on steam engine; test efficiency using Carnot's concepts; begin repeating the experiments of Faraday and empirically derive the basic laws of electricity and magnetism, including Ohm's law	Animal physiology and biochemistry continued; the work and life of Pasteur	Experiments in animal physiology and biochemistry continued
9.75	11.75	Maxwell's work on the wave theory of light and the derivation of Maxwell's equations and their applications; continue study of Gauss' mathematics and physics	Electromagnetic motors and generators, construction of batteries, transmission of electromagnetic waves, early work of Tesla, the telegraph and the wireless constructed	A course in botany and plant physiology; begin experiments in plant genetics after Gregor Mendel	Study and dissection of major plant species; field studies, microscopic dissection, plant breeding per Gregor Mendel

Avg. Level	Avg. Age	Psychosocial		Integration	
		Psychosocial Theory	Psychosocial Practice	Integrative Theory	Integrative Practice
9.00	11.00	Detailed analysis of the American and French Revolutions; detailed analysis of the writings of Jefferson and his correspondence; comparisons between Jefferson, Washington, and Napoleon; how Napoleon betrayed the French Revolution in the pursuit of personal power; how the U.S. government betrayed the Libertarian ethic	Write essays comparing the ethical course of the American and French Revolution; relate the ethics of Spinoza to these revolutions; relate to evolutionary ethics and show where they went wrong	Artistic synthesis in the early work of Goethe and the music of Beethoven; ethical synthesis in the philosophy of Lessing, Goethe, and Moses Mendelssohn and their interpretations of Spinoza	Reorchestrate and perform Beethoven's *Grosse Fugue* for octet; read Goethe's prophetic poetry; write a sequel to the *Sorcerer's Apprentice*
9.25	11.25	The philosophy of Kant, biography, *The Critique of Pure Reason* and *The Critique of Practical Reason*; compare to Spinoza; Kant's cosmology compared to LaPlace; explain Catholic hostility	Write essays on the scientific and ethical implications of Kant's philosophy; analyze in terms of the evolutionary ethic	Artistic synthesis continued in the work of Goethe and Beethoven; Goethe's *Sorcerer's Apprentice* and pessimism, the romantic hope and self-delusion	Produce as a group project Goethe's *Faust* and performance of Beethoven's *Ninth Symphony* for several octets
9.50	11.50	The philosophy of Hegel—how he could be so wrong and so influential; Hegel and the misinterpretation of Spinoza; Hegel's theory of history and ethics; Hegel as the father of Marxism and Naziism; de Tocqueville as a visionary and prophetic historian	Essay explaining Hegel's influence through present times; a comparison of Spinoza and Hegel—how could Hegel so misunderstand Spinoza and deceive himself and others? Why was de Tocqueville so accurate in his predictions?	The romantic poets, Byron, Shelley, and Wordsworth; the art of Watteau, Houdon, David, and Degas; the music of Berlioz and Liszt; Wagner as the musical equivalent of Hegel	Write epic poetry on a hopeful future from a romantic perspective; do a musical satire on a Wagner opera; paint a heroic romantic painting
9.75	11.75	A history of the world from 1775 to 1910; development of major ideas and philosophies, with particular attention to USA, Britain, France, Germany, Japan, and Russia; basic economics from Adam Smith to Marx and Engels	An essay explaining the Newtonian model and its influence on the intellectual history of the world; why Islam, India, and China were so far behind, why Japan was able to catch up	An ethical analysis of European and American imperialism; libertarian and socialistic ethics; the ethical turmoil of the age of liberty and social obligation; read *War and Peace* by Tolstoy; the paintings of Turner and the Impressionists	Read and analyze Pushkin, Melville, Dickens, Hugo, Balzac, Dostoyevski, Tolstoy, George Eliot; study the music of Mahler and perform *Das Lied von der Erde*

Avg. Level	Avg. Age	Physical		Biological	
		Physical Theory	Physical Practice	Biological Theory	Biological Practice
10.00	12.00	Gauss' mathematics and physics continued; general thermodynamics, the work of Boltzman Clausius and Gibbs, Maxwell's demon, the inventions of Edison and Tesla; the work of Mendeleev and the beginning of organic chemistry; probability theory as understood by Gauss and Galton	Construction of AC generators and regulators, simple radios, light bulbs, and recording devices; begin design and construction of simple internal combustion engine; experiments in organic chemistry and synthesis of organic compounds	The life and work of Charles Darwin and Wallace, the evolution of evolutionary ideas, the theory of natural selection, and the three laws of thermodynamics; the work of Pasteur continued	Each student gathers evidence for and against Darwinian evolution, taking into account basic genetic knowledge and probability
10.25	12.25	Non-Euclidean geometry and statistical mechanics; introduction to systematic probability theory and statistics; continue work in thermodynamics and organic chemistry; the work of W.R. Hamilton and Henri Poincaré is studied	Continue work of previous quarter; construct interferometers and repeat the Michelson/Morley experiments; repeat experiments of Planck to derive Planck's constant; develop and derive the special theory of relativity; begin construction of automobile; continue internal combustion engine project	Neo-Darwinian theories of evolution and evolutionary genetics up to R.A. Fisher's *The Genetical Theory of Evolution*; explain disease and parasites in evolution	Do genetic experiments with fruit flies and molds, giving evidence for and against neo-Darwinism, theories of evolution, bacteriology; systematic study and laboratory work
10.50	12.50	The physics of the 20th century, including the General Theory of Relativity up to the discovery of quantum mechanics, is presented as a year course in modern physics (with an advanced calculus prerequisite) as it might have been given at Harvard, Cambridge, or Gottingen in 1925; physical and organic chemistry, also a year survey course; finish study of Henri Poincaré	Continue work on automobile; repeat experiments leading up to Bohr atom; handmade basic tubes for radio and oscilloscope; construct a more advanced radio and oscilloscope using tubes; make photocells, synthesize organic compounds	Introduction to cell biochemistry and advanced genetics; begin chromatography and electrophoresis for separating common biochemical constituents of mammals	The chemical structure of the constituents of life; isolating nucleic acids and proteins, determining their properties through chemical and spectrographic analysis; create genetic mosaics
10.75	12.75	Continuation of previous quarter; relate physical chemistry and organic chemistry to biochemistry; theory of x-ray machines and electron microscopes	Continuation of previous quarter; finish automobile; study of x-ray machines and electron microscopes; organic chemistry laboratory; motion pictures	Continuation of previous quarter; introduction to x-ray crystallography and electron microscopy for the study of large molecules and viruses	Continuation of previous quarter; use of x-ray crystallography to determine chemical structure; electron microscopy of viruses and large molecules

Avg. Level	Avg. Age	Psychosocial		Integration	
		Psychosocial Theory	Psychosocial Practice	Integrative Theory	Integrative Practice
10.00	12.00	The theories of Marx and Engels in detail, *Das Kapital* and the Dialectics of Nature; the ideas of August LeComte and social science in general; the psychology of William James	Critical essay on Marxism and dialectic materialism; what is wrong and what is right about theory, what is the scientific evidence for and against the theory; why is social science so full of nonsense?	Ethical analysis of Marxist philosophy and ethics; how and why Marxism violates the evolutionary ethic; read *The Brothers Karamazov* by Dostoyevsky	The music of Arnold Schoenberg, the plays of Frank Wedekind, the early paintings of Picasso and the Cubists; the opera *Lulu* by Alban Berg is performed
10.25	12.25	The philosophy of Nietzsche and Spencer; evolutionary ethics as propounded by Spencer; ethical Darwinism, an introduction to the life and ideas of Sigmund Freud, the rise of racist fascism in Europe	Essay comparing the neo-Darwinian ethics with Marxism; the incipient Lamarckianism in Marxism compared to its ethics; essay on European racism and fascism growing out of social Darwinism	Ethical analysis of neo-Darwinian philosophy and of social Darwinism; how and why social Darwinism and fascism violate the evolutionary ethic; Freud as a Newtonian psychologist looking for mechanistic explanations which may not exist; ethical implications of the unconscious	The music of Richard Strauss, *Ein Heldenleben, Also Sprach Zarathustra*, and the opera *Elektra; Man and Superman* by G.B. Shaw is also performed
10.50	12.50	World history from 1910 to 1925; the basic writings of Lenin and a study of his life; World War I and the Russian Revolution, the world fear of communism, Leon Trotsky as an idealized communist; Freud's later works	Essay on the origins and consequences of World War I; essay on the origins and consequences of communism in Russia; essay on how the brilliant, ethical Trotsky went wrong and helped create a Frankenstein	An ethical analysis of how the Soviet Union betrayed its own revolution and turned into a monster; how the centralization of power makes corruption inevitable; read *Darkness at Noon* by Koestler and *Animal Farm* by Orwell	The music of Prokofiev and Shostakovich; the films of Sergei Eisenstein, including *Ivan the Terrible*; perform the Shostakovich opera *Lady Macbeth of Murmansk* and Mussorgsky's *Boris Gudenov*
10.75	12.75	World history 1925 to 1939; the basic writings of Mussolini, Hitler, fascism, Stalin, and Soviet communism; a study of Hitler and Stalin as complementary personalities who changed history; early works of Pavlov and Jung	Essay comparing the conflicting ideologies and economic factors leading to World War II; what could have been done to prevent World War II; why the United States was so immune to both communism and fascism	An ethical anlysis of how capitalistic greed and the political cowardice and vindictiveness of the European democracies made World War II inevitable; Read *Winds of War* by Wouk	The music of Stravinsky, the early art of Dali, the films of Chaplin, Buñuel, Lang, and Pabst, plus Academy Award winners; perform Hindemith's opera *Mathis der Mahler* and Brecht's *Mahagonny*

Avg. Level	Avg. Age	Physical		Biological	
		Physical Theory	Physical Practice	Biological Theory	Biological Practice
11.00	13.00	Continuation of previous quarter; begin to focus chemical studies on biochemical processes and molecules; theory of ultracentrifuges and mass spectrographs	Continuation of previous quarter; begin construction of small airplane and learn to fly it; begin design and construct black & white television set; continue experiments in atomic and nuclear physics; study of ultracentrifuges and mass spectrographs	Continuation of previous quarter; use of mass spectrograph and ultracentrifuge	Continuation of previous quarter; use of advanced techniques to determine gross structure of RNA, DNA, and proteins
11.25	13.25	Continuation of previous quarter; begin an introduction to quantum mechanics and how it explained and enabled us to predict and control the facts that were causing paradoxes; study Pauling's work on the chemical bond	Finish small airplane; complete construction of black & white TV set; begin practice flying airplane; experiment with microwaves; build simple radar transmitters and receivers	Continue work of previous quarter; analysis of biochemical molecules and their reactions	Continue work of previous quarter; experimental physiological chemistry
11.50	13.50	The formal study of quantum mechanics continued; work of Bohr, de Broglie, Schroedinger, Heisenberg, and Bohm; critical experiments analyzed; Von Neumann's formalization of quantum mechanics into operators in Hilbert space; the predictive power of quantum mechanics; advanced theory of probability and statistics	Perform experiments to show that photons, electrons, and other quantum entities are both waves and particles; construct transistor, laser, and hologram; begin design and construction of color TV; begin design and construction of analog and digital computers	Biochemical analysis of DNA and RNA; how their structure was derived and how heredity and biological information is encoded in these molecules; relate to Pauling's work on the chemical bond	Biochemical isolation of DNA and RNA; preparing crystals for x-ray diffraction, determine their structure with exactitude; determine exact structure of insulin molecule
11.75	13.75	Continuation of previous works; Einstein's objections to quantum mechanics, including the EPRB paradox, and how these objections were resolved; quantum mechanics and chemistry	Continuation of previous experiments and constructions; experiments in superfluidity and superconductivity as macro quantum events	Molecular biology of the gene; how to read the genetic code; quantum processes in DNA	Experiments in gene splicing and working with recombinant DNA in bacteria; genetically engineered bacteria to produce human interferon

Avg. Level	Avg. Age	Psychosocial		Integration	
		Psychosocial Theory	Psychosocial Practice	Integrative Theory	Integrative Practice
11.00	13.00	World history 1939 to 1949; the later theories of C.G. Jung and I. Pavlov; the philosophy of existentialism	Write essay on the role of the United States in World War II and how it erred in its ethical obligations and thereby lost the peace; write essay on what the world and the United States would be like if the United States and England had united to prevent other nations from acquiring nuclear weapons	An ethical analysis of the factors leading to WWII and how democratic ideology is used to combat communism; the communist views of democratic capitalism, the democratic view of totalitarian communism; Read *War and Remembrance* by Wouk	Nazi films of Leni Riefenstahl; a study of *Citizen Kane*; students write script, score, produce, and direct film of their own as group project using TV camera; study films of the Holocaust and World War II
11.25	13.25	The basic writings of Jean Paul Sartre, Camus and other modern existentialists; the philosophy of Teilhard de Chardin; an introduction to behaviorism starting with work of Watson	Write essay and contrast the ethical consequences of existential pessimism with evolutionary optimism, analyzing the social implications of a society that produces both; do simple conditioning experiments with rats	Ethical analysis of existentialism as the national philosophy of France and how that led to French defeat and collaboration in WWII; the creativity of the French	The films of Jean Renoir, Cocteau, and Clement; the music of "Les Six"; the paintings of Matisse and late Picasso; make a film in the French style
11.50	13.50	The writings of B.F. Skinner on behaviorism; study of the school of behavior therapy; animal and human comparisons; compare to the psychotherapy schools spun off from Freud	Conditioning experiments with rats, cats, and dogs; biofeedback experiments with humans; use of conditioning to break bad habits, compulsions, and phobias	Ethical analysis of the implications of behaviorism; show how this is a classical model of a quantum process; show how ethics can overcome conditioning and how ethics can also be destroyed by conditioning	Study of psychological films from *Spellbound*, *7th Veil*, and *The Cobweb* to *A Clockwork Orange* and *The Prisoner*, as a group project make a B&W film satire of *Walden II*
11.75	13.75	A survey of 20th century philosophy after Bertrand Russell; start with G.E. Moore's writings on ethics; study *Tractactus Logicus Philosophicus* and Wittgenstein's *Philosophical Investigations*, Schlick's and Hare's work on ethics, Russell's analysis of matter and analysis of mind, Schroedinger's *What Is Life?*, The Vienna Circle, and Logical Positivism	Write essay on the relationship between science and the school of rational analysis; write essay on how the academic study of ethics is becoming trivial and unscientific; how can ethics be made scientific, why has no one taken the lead of Spinoza and continued working toward a rational scientific ethics?	Ethical implications of quantum mechanics for human behavior; relationship between determinism and free will; chance and necessity in evolution and human choice; read *Chance and Necessity* by Monod	Study the paintings of Dali and other surrealists; study Dali's films with Buñuel and Buñuel's later films; make a film as group project on expressing surrealism and ethics

Avg. Level	Avg. Age	Physical		Biological	
		Physical Theory	Physical Practice	Biological Theory	Biological Practice
12.00	14.00	A one-year synthetic study in cosmology uniting field theory, particle physics, and the Big Bang theory; show the evolution of matter, space, and time from the instant of the Big Bang to the present; discuss alternative explanation such as the steady-state theory	Astronomical observations of astrophysics, quasars, and possible black holes; the different types of galaxies are observed; the red shift and radio astronomy are studied and observed; results of experiments in high-energy particle physics are analyzed	A year study of chemical evolution after Blum, Calvin, and Manfred Eigen; show possible deterministic origins for DNA and protein and how autopoiesis might start as a quantum process; relate information and entropy, information theory and thermodynamics	Laboratory simulations of chemical evolution leading to protein and DNA through many different pathways; show how RNA encodes information to DNA
12.25	14.25	Continuation of previous quarter	Continuation of previous quarter	Continuation of previous quarter	Continuation of previous quarter
12.50	14.50	Continuation of previous two quarters	Continuation of previous two quarters	Continuation of previous two quarters	Continuation of previous two quarters
12.75	14.75	Continuation of previous three quarters; the latest cosmological models of Guth, Hawking, and Hoyle; their successors	Continuation of previous three quarters; observation of possible primordial strings as indicated by large gravitational lenses	Continuation of previous three quarters; trace a possible pathway to RNA, protein, DNA, cells	Continuation of previous three quarters; try creating simple proteins that when combined with RNA produce DNA in autopoiesis with the protein

Avg. Level	Avg. Age	Psychosocial		Integration	
		Psychosocial Theory	Psychosocial Practice	Integrative Theory	Integrative Practice
12.00	14.00	A survey of the leading theories of psychotherapy and humanistic and transpersonal psychology during the 20th century; show that they are transitory fads which almost never last and that they do not have a scientific base even though they produce millions of true believers	An analysis and essay on psychofraud as a human phenomenon; why will persons resist scientific explanation to behavior? why are clearly untrue fads with no scientific basis so popular? an essay on the human potential movement	The psychology of self-deception and its relationship to ethics; why is it possible to virtually eliminate self-deception from physical and biological science but not from social science?	The art of self-deception and quantum vision, the drawings of M.C. Escher, self-reference based drawings and paintings; study of the films of Stanley Kubrick, particularly *2001* and *A Clockwork Orange*
12.25	14.25	A survey of late 20th century economics beginning with Keynes' General Theory, covering the ideas of Paul Samuelson and Milton Friedman; supply-side economics and non-zero sum games; the economics of creativity	Essay on the inability of the leading economists to deal with creativity as the central factor in economic growth; the ethical obligations of the rich toward the poor	The economic implications of evolutionary ethics; the ethical implications of genetic engineering and eternal life; is it ever wrong to share knowledge? is it ever right to impede the flow of knowledge?	The music of Penderecki as a manifestation of 20th century entropy and ethical obligation; performance of Penderecki's *Dies Irae* and *The Devils of Loudon* and *Requiem*
12.50	14.50	A world history from 1950 to the present showing that no combination of socialism or capitalism is likely to work; show that Islam and all other societies alienated from western civilization are evolutionary deadends; the need for an alternative	Write essay showing how in their structure and in their actions both socialism and capitalism repeatedly violate the evolutionary ethic; essay on an alternative political socio-economic system to both capitalism and/or socialism	Art as a medium of protest; read Koestler, Pasternak, and Solzhenitsyn; read the latter's criticisms of the West; read the anticapitalistic writings from Clifford Odets to Arthur Miller's *Death of a Salesman* and *The Crucible*	Study the films of Costas Gavras as indictments of both socialism and capitalism; *Z, The Confession, State of Siege, Apocalypse Now,* and *The Godfather* series; begin a TV film as a group project expressing hope in the midst of an entropic world order
12.75	14.75	An introduction to a general theory of evolution unifying ethics, evolutionary theory and science; show the place for mysticism in the scheme of things and how mysticism inadequately balanced by science always leads to self-delusion; develop a thermodynamic, information-theoretic model of evolution and creativity	Write essay showing how to implement the general theory of evolution and the evolutionary ethic as an alternative socio-economic and political system on any scale in any country; take into account practical constraints; do a mathematical prediction of possible futures for evolution and creativity	Study the recent writings of ethical Christians within and without the Catholic church; see how Christianity and Judaism are evolving a more humanistic ethic more in harmony with the evolutionary ethic; relate to other major religions	Finish the film; write an essay on how persons who practice the evolutionary ethic can best communicate with adherents of each of the major religions, using art and common ethical values

Avg. Level	Avg. Age	Physical		Biological	
		Physical Theory	Physical Practice	Biological Theory	Biological Practice
13.00	15.00	Seminar on cosmology covering latest findings, theories, and alternative ideas, usually will cover the most important findings and breakthroughs of the last year; unify field theory, quantum mechanics, particle physics, and astronomy	Observations and computer simulations of cosmological models; derivation of original models	Seminar on genetic engineering and recombinant DNA; latest findings, ideas and theories	Experiments in engineering new life forms and correcting genetic defects in mammals
13.25	15.25	Seminar on chemical evolution leading to living cells; latest findings, theories, and ideas; how can autopoiesis be induced at the precellular level?	Experimental attempts to recreate the chemical evolution that led to the first cells in the laboratory; any form of chemical autopoiesis will be evaluated	Seminar on brain physiology and function; how the brain contributes to our intelligence and our mind; the brain as a classical device and the brain as a quantum device are emphasized	Experiments in understanding and enhancing brain function; life-style and the brain; EEG and brain physiology during autopoiesis
13.50	15.50	Seminar on the latest findings and discoveries in solid-state electronic devices, memory chips, microprocessors, pico-circuits, etc.; discuss performance, manufacturing techniques, and areas for new research; solid-state physics and chemistry appropriate to these devices	Laboratory and experiments on how to create micro- and pico-circuits; developing the crystals and modifying them; design and construction of advanced computers	Seminar on human health; how to prevent and cure diseases; focus on viral infections, degenerative diseases, and the aging process	Laboratory and clinic on preventive medicine and health maintenance for maximization of creativity
13.75	15.75	Seminar on latest discoveries in macro quantum physics, lasers, holography, super-conductivity; developments of other important technologies like quantum computers, artificial intelligence, and any technological breakthrough in any field; also, extensions of EPR and nonlocal interactions	Laboratory and experiments with important new technologies and processes covered in or related to the accompanying seminar; quantum technologies and advanced energy systems are experimentally treated	Seminar on the latest findings in biological evolutionary theory, particularly scientifically plausible deviations from orthodox Darwinian paleontology, genetic distance, and other findings relevant to evolutionary biology	Laboratory and field studies in paleontology, evolutionary genetics, and computer modelings of the evolutionary process, particularly relating to rates of evolution, punctuated equilibrium, and quantum evolutionary processes in evolution

Avg. Level	Avg. Age	Psychosocial		Integration	
		Psychosocial Theory	Psychosocial Practice	Integrative Theory	Integrative Practice
13.00	15.00	Seminars in evolutionary ethics and the general theory of evolution as an integrating theory in the social sciences; correct theory where it seems wrong and extend where it seems right; test the theory entirely by its ability to predict	Use the general theory of evolution to integrate the social sciences and other sciences when possible into a unified whole using mathematical models and emphasizing information theory and thermodynamics	Seminar on the latest developments in art which express a synthesis of ethics, humanities, and technology	Experimental creation of films, study of original films and their techniques; other techniques that integrate ethics, humanities, art, and technology
13.25	15.25	Seminar on human creativity and how to maximize it; show relationship between ethics and intelligence and how to maximize their interactions; study the interaction of ethics, science, technology, mysticism, and human organization; show both negative and positive findings	Experiments in how to maximize creativity for different persons in different environments; test the limits of what can be done for persons driven by fear who have not been able to make a commitment to the evolutionary ethic; test to see what can be done environmentally to maximize intelligence for those who are committed	Seminars on musical theory and composition; development of notation and expressive media for dance and opera; discuss latest work with high ethical content	Original composition of music, dance, and opera; performances of new works and interactions with latest technologies
13.50	15.50	Seminar on the economics of creativity and how best to organize the creative economic output of individuals; compare to other work in economics and the latest findings in these fields; test and improve the theory of creative transformation, octet formation, and autopoiesis	Laboratories in alternative forms of human organization for maximizing economically relevant creativity; kinds and numbers of persons and how best to communicate and assure creative feedback; are there creative alternatives to self-screening and selection into octets?	Seminars on the latest developments in the plastic arts, drawing, painting, sculpture, carving, ceramics; new forms, styles, and techniques are discussed; emphasis is on art with an ethical content	Workshops in the plastic arts; individual and group projects in any combination of plastic arts
13.75	15.75	Seminar on the prediction of historical and social events using the general theory of evolution and other techniques that made correct predictions in the past	Laboratory on how to organize octets into larger systems without losing creative output; how to delegate power within systems of octets without producing corruption and a loss of liberty; experimental techniques for predicting social changes and the future	Seminar on world literature and philosophy, what is being expressed and how, how it relates to the general theory of evolution, what can be incorporated into the general theory, and what is detrimental to its development	Critical readings and group discussions of important literary, philosophical, and religious writings; write alternatives to rejected ideas

so that parents will not use reward and punishment to condition students. Each octet can effectively teach 64 students. It is predicted that the effectiveness of the teaching and the learning will be maximized if the students are organized as tracked, mutual-interest, comparable-ability student octets engaged in autopoiesis. Each octet of teachers in turn interacts autopoietically to coordinate and integrate its teaching. Eight octets of teachers, with 512 students, is probably the optimal upper limit for school size to achieve the maximum amount of diversity and choice for the students. There would also be two coordinating octets of teachers made up of one male and one female from each of the teaching octets. Overall school policy would be determined by unanimous consent of the two administrative octets in consultation with the teaching octets from which they come.

Schools themselves could go several ways: (1) emphasize a fixed rate of progress (track) and teach up to eight levels; (2) have a single level of studies with up to eight standards of progress (tracks); or (3) have a combination of the two. Local circumstances would dictate what would be best for the students. It is important that the students be able to move along at the rate that is best for them. Students could either choose a school that matched their rate of progress and had several adjoining levels or find a school at their level which offered the multiple rates of progress option for whatever level they wished to assume. These combinations and permutations of possibilities should be worked out by market forces and the teachers themselves.

Teachers can probably best teach students who match their own natural rates of progress. However, some teachers are very patient and compassionate with slow students, who learn much more slowly than the teachers did when they were at the same level. These more versatile teachers would be ideally suited for schools with multiple tracking at a single level. In the curriculum outlined on pages 284–305, we assume a single fast track for the brightest, quickest students, since it is these types of students who will probably first use this system. A level is a year of study for the quickest student group. These fast students would start at age 3 and go at the fastest possible rate. On the other extreme, very slow students could start at age 8, for example, and go at one quarter this rate. Almost the entire population would fit between these two extremes.

This approach to education would greatly accelerate the pace of learning because everything is relevant, interesting, and readily available in a loving context without fear. Everything the student learns is always related to everything the student knows. My best estimate, based on experiments I have personally conducted, is that many students will learn at a 400% higher rate than in our current, classical educational system that emphasizes intelligence over creativity. The preceding lifetime curriculum demonstrates a quantum educational process that catalyzes itself. Remember, the slowest students could move at one fourth this rate.

The thousands of possible variations on the preceding outline of the integrated education, designed to maximize creativity, can be made available to almost every human being by reducing the rate of learning in any or all of the four key areas for those who cannot or prefer not to keep up the pace as given. Up to eight rates of progress, or tracks, are feasible within this system. The last or 13th level is an unending level which is repeated every year with new material. Once a person at any age has finished the first twelve levels, he or she may then enter the 13th level and stay there for several cycles to develop his or her creative maturity. The 13th level may also have multiple tracks. Any student may take any class at any school, and may generalize or specialize. No pressure is put on the student to conform academically. The student is simply presented with opportunities to accept or reject. The choice is always the student's. Therefore, some students may, if they wish, spend all their time studying music or mathematics and boycotting the other classes and courses. However, I predict that if they are given a free choice from an early age, almost all students will choose to generalize and optimize the curriculum as outlined.

A person finishing and understanding at least one cycle of the 13th level will be extremely well prepared to go into almost any specialized professional graduate school program in physics, astronomy, chemistry, molecular biology, zoology, medicine, botany, any engineering field, architecture, philosophy, psychology, history, music, art, film, etc. The objective is not necessarily to replace specialized professional graduate schools, although this may be a side effect, but to give persons a foundation and a perspective that will maximize their creativity, whatever they choose to do in life. This type of education would be expensive but less than the typical $10,000 per student per year in a good private school without room and board. By integrating this educational system with the economic system of the following chapter, we could soon make available this type of education to every human being and his/her children who wish it, regardless of their economic means. Creative education is the best possible investment.

As will be seen, the educational and economic systems will support and enhance each other. The problem at this time is how to start to organize the schools so that they become a self-catalyzing process.

Educational Organization

The preceding curriculum is merely a brief outline showing one of many thousands of paths that could be taken through the totality of human knowledge in order to maximize creativity. To a great extent it reflects the education I wish I could have had for myself and my children. This knowledge, except for the ethical theory, is widely available. Yet it is an education that is not available at any price anywhere in the world. The reason for this is that part of the bureaucratization process in the academic community

involves the compartmentalization and isolation of knowledge in such a way that everything is maximally difficult to learn and creativity is minimized. This is not done consciously or maliciously, but it is an unconscious response of the academic community to its own fear in a system that is based on fear. The academics have the illusion that the more specialized, irrelevant, and difficult their fields, the more secure they will be.

The greatest fear induced into the members of the academic community is the fear of making an error in front of their peers. The greatest disgrace is to say something wrong and not appear clever. The academics have been conditioned to be so terrified of erring and of appearing less than clever that they almost all eventually fall into the destructive trap of narrow specialization and debunking of any truly original thinking. They try to appear clever while repeating conventional wisdom over and over. They obfuscate their knowledge with jargon, abstraction, and irrelevancy to make it as difficult to understand and as boring to study as possible. In this way the specialists protect their specialty from poaching by more creative generalists, but they still remain afraid. Persons whose major concern is appearing clever and never making an error will never create.

It is impossible to create if one fears error. Indeed, if we are to be maximally creative we must be prepared to make many errors. Science will correct our errors. We always learn more by trying or thinking something new and making an error, and then correcting it, than by repeating the old and never making an error. The minimum confidence we must have in our own creativity is to believe that we can correct our errors. Scientific method can always permit us to overcome our errors if we apply it without fear, while respecting objective truth however it manifests itself.

This must be the central organizing principle of the School for Evolutionary Education (SEE). SEE is what we will call all schools which follow the spirit of the preceding curriculum and refuse to use fear to control their students and their faculty. The sole motivation of the students and faculty must come from the love of learning and creating, and from communicating these to others without fear. They must learn to care nothing for appearing clever. They must learn never to fear error in the pursuit of truth. The latter involves constant openness to negative feedback and scientific method. Ironically, this integrated, holistic, open, creative structure will enable students to learn any specialty at least twice as fast as they could if they focused exclusively on the specialty, and without having their fear increased or their ethics or their creativity diminished.

The problem with fear is that it is contagious. Teachers who are driven by fear will instill fear in their students. In this way the cycle of self-destruction is repeated in our schools in a downward spiral until almost everyone is unethical and destructive. Only those with the courage or intelligence not to be intimidated by the academic bureaucracy plus the guidance and the will to educate themselves remain creative. These are the per-

sons who survive the academic bureaucracy, but they usually become absorbed by the bureaucracy and rarely do anything to improve it. It is these persons who must form the nucleus of SEE.

The major problem for creating SEE is not a lack of funds, as the next chapter will show. The major problem is how to recruit and organize qualified teachers. The teachers, as well as the students, must be motivated solely by the desire to learn, teach, and create. To help maximize the creativity of another is the most creative thing we can do. That is why no one should ever fear an Ethical State. Qualified teachers must realize this. They must be prepared if necessary to make economic sacrifices and work in an insecure environment in order to have the opportunity and the privilege of maximizing the creativity of their students. Furthermore, the problem of specialization is such that most of the potential teachers are far more specialized than the students who would complete the thirteen levels. At first, it will take at least 64 teachers—probably closer to 128—to properly cover the knowledge at the thirteen levels. The larger the number of teachers the more difficult it will be to integrate them creatively. Remember, eight is the optimal number for creative interaction.

Therefore, the first task is to create an octet of teachers to create more teachers. They will teach others as well as themselves. This will be done by exposing more specialized, but creative, adults to the thirteen levels until collectively the skills exist among 32 men and 32 women for teaching all thirteen levels. These 64 men and women will then form the faculty for the first SEE, which will be a single-track school with all thirteen levels. It will teach children and adults and compensate for those who are highly specialized. Those who complete all thirteen levels (remember that the 13th level should be repeated at least twice) will then be able to become members of the faculty at other SEEs until SEE becomes available to all humanity.

The indications so far are that it will be easier to recruit artistic generalists who have relatively low levels of fear and are relative scientific illiterates than to recruit scientific generalists who have an adequately low level of fear. It is easier to increase the scientific literacy of the scientifically ignorant who are ethical than it is to lower the fear of scientists who are unethical. The scientific disciplines appear to be the ones most dominated by fear. Furthermore, truly creative scientific generalists are so rare and valuable that they have innumerable opportunities to do their "own thing." It will take time for them to learn that their "own thing" can best be done within SEE, or their own version of SEE if they wish. They, more than others, have all options open, if they can share their creativity by loving humanity. This will maximize their creativity in the long run. Therefore, the plan is to put together the best qualified teaching octets that can be created within the near future; then through self-study and tutorials to bootstrap them to a level at which they can continue to teach themselves and others. There will be no compromise regarding fear, only regarding

knowledge. Additional teaching octets will be created whenever possible. Fortunately, it is possible for relatively fearless persons to learn from even highly fearful persons when the latter are employees of the former.

In the academic bureaucracy, the student and his/her creativity are the least important factors in decision making. At SEE these are the most important factors. The major task of the early teaching octets will be to design and create textbooks, syllabi, workshops, and laboratories for the SEE teaching program. These will then be used to teach other teachers until it is possible to begin a full-scale school or a system of schools with all thirteen levels. It makes sense to eventually have each thirteenth level be a separate school built around one or more teaching octets. In the meantime the process of creative transformation may lead to better techniques for lowering the fear of persons who are intellectually but not ethically qualified to be SEE teachers. We have made significant progress in the last year in being able to help persons who previously seemed beyond help. Now it only takes enough courage to (1) try the process of creative transformation and (2) openly receive gentle, negative feedback from loving friends over a few months. It only takes a mild commitment to play the Game of Life.

Once eight teaching octets who cover the entire thirteen levels have been created, then a private school will be set up on an experimental farm near a large river and a seaport, where most of the field studies, workshops, laboratories, and building projects can be implemented. An appropriate tuition will be charged per student. Work-study scholarships for half-time study and half-time work will be given to students whose half-time labor is worth their half-time tuition. Full scholarships will be given to students with the highest creative potential to the limits that funds for these purposes are available from the SEE economic network. Full-time employees of SEE or its affiliates will be given full scholarships for all of their children. In this way the schools will bootstrap themselves by supporting and being supported by SEE's economic network. The economic network will guarantee employment to anyone who finishes the thirteen levels. The problem will be how to keep this from serving as an extrinsic reward to the students.

Extrinsic Rewards

Extrinsic rewards are such an integral and accepted part of our educational system that it is difficult to imagine that it might be otherwise. From the start, grades and teachers' praise are used to turn education into an intellectual contest. Then admission to prestigious schools is used as another extrinsic reward. Finally expectations are raised about employability and income if one merely conforms to the rules of the academic bureaucracy. Creativity is neither a means nor a goal within the educational bureaucracy. The major motivation for education seems to be to obtain a union card.

Young children are inherently honest and ethical. The fact that almost all young children despise school should tell us something, particularly when almost all children love doing creative work of their choosing (i.e., play), from building model airplanes and training horses to planting gardens and programming computers—all without extrinsic rewards. Human beings have an innate desire and need to maximize their creativity. This is the basis of all ethics and ethical play. This aspect of human nature can be destroyed by extrinsic rewards and punishments, as considerable experimentation with both chimpanzees and humans has shown [108]. The question is how far we can go in removing extrinsic rewards and punishments.

Punishments are not a problem within SEE, since it is both unethical and suboptimal from a conditioning point of view to shape behavior with threats or punishment, although punishment in the form of social disapproval or expulsion for nonconformity is an integral part of the educational bureaucracy. Indeed, threats and punishment are totally ineffective in working with moral persons and merely destructive to ethical persons. Therefore, no threats or punishments in any form will be used at SEE. Rewards are more complex.

Almost all parents and behavioral psychologists advocate rewarding desirable behavior in order to reinforce it. Experiments with chimpanzees, dolphins, and humans indicate that extrinsically rewarding creative or innovative behavior causes that behavior to increase. The problem is that, if the rewards cease, then the creative or innovative behavior falls *below* what it had been before the extrinsic rewards began. Therefore, since intelligence has been increasing along with the creative behavior, and $C = IE$, then extrinsic rewards for creative behavior must diminish ethics. Part of an ethical education must be to make persons indifferent to extrinsic rewards and punishment. The only goal must become to maximize creativity for ourselves, others, and for the collective, irrespective of extrinsic rewards or punishments.

At the same time we know that unethical means cannot achieve ethical ends. Therefore, we can neither deceive nor mislead students about the extrinsic rewards associated with maximizing creativity. We must instead teach them to regard extrinsic rewards as essentially trivial. One of these essentially trivial extrinsic rewards is that *maximizing creativity maximizes wealth for those who retain control of the fruits of their creativity.*

Persons with the knowledge and the creativity induced by completing the thirteenth level of the SEE educational program will be extremely valuable to any individual or organization which depends on innovating new and better products and services. These constitute all individual humans and their organizations except organizations that are highly bureaucratic and the individuals who staff those bureaucracies. The latter, e.g. most corporate monopolies, political parties, and government agencies, specialize in living parasitically off the former. Therefore, even parasites are ulti-

mately dependent on human creativity. In destroying creativity they are also destroying their host, which is not an unusual mode of operation for parasites. More will be said of this in the next chapter.

For now we accept as a given that creativity is the single-most valuable attribute that an employee can have. Furthermore, the more the creativity is a result of ethics, the more valuable a given level of creativity is, since honest ethical employees are always preferable over less honest and less ethical employees in all organizations except bureaucracies; and further still, high intelligence with low ethics is an unstable combination which produces destructiveness. Therefore, in a market economy, persons finishing two or more cycles of SEE's thirteenth level will have labor that is worth at least twice the labor of any recent, conventional college graduate and, eventually, probably a thousand times any specialist's salary. True creativity is almost priceless. Any ethical, creative organization will give employees a fair return for their labor and will wish to hire the most creative ethical employees it can find. Furthermore, since the SEE economic network will be investing in SEE educational programs (see the next chapter), and it would be unethical to subsidize any parasitical organization, it must guarantee those who finish the SEE educational program high-paying positions, but in no way compel the SEE students to work for the network. If SEE has been successful, the students will work for SEE because it maximizes *their* creativity.

The potential for corruption due to this necessary extrinsic reward is ameliorated by the following considerations:

1. Students are taught within SEE to value creativity as an end in itself and regard extrinsic rewards/punishments as essentially trivial.
2. The extrinsic reward is far in the future for most students and does not serve as a conditioning factor. Its primary function is to lower economic fear in the students and their families.
3. The SEE economic network will reward the students it employs not by high, lifetime, guaranteed salaries equivalent to a tenured professorship, but primarily by (a) giving them an equitable percentage of the profits that their creations produce plus (b) providing educational benefits at SEE for them and their children.
4. Both SEE and its economic network will encourage SEE students to become part of teaching octets and help educate more highly creative generalists. What we wish to minimize is SEE students prostituting their creativity in the service of destructive bureaucracies out of economic fear.
5. The SEE economic network will always offer all creative persons the opportunity to develop their innovations in equitable partnership with the network, while studying or teaching at SEE, as an alternative to working directly for the network.

6. Both SEE and its economic network will regard teaching, research, and inventions or other creations that maximize creativity as much more important than inventions which maximize immediate profits. From an economic point of view creativity is the best long-term investment that can be made.
7. Within the SEE economic network, studying and teaching at SEE will be considered as the major extrinsic reward for employees and their children for working within the network. Using opportunities for learning, teaching, and creating as an extrinsic reward for activities that are normally remunerative has the opposite effect of using extrinsic rewards for activities that are normally creative.
8. Finally, we should never use the remote possibility of an adverse effect as an excuse for not doing what is right. Inaction is always unethical. It is ethically necessary that the SEE economic network retain as many SEE students as possible by whatever ethical means are feasible in order to deny these students' creativity to destructive organizations. One of these ethical means is to offer equitable jobs to all its students.

For the preceding eight reasons all SEE students will be offered jobs within the SEE network with remuneration in proportion to their objective creativity. These jobs will also be open to any other creative persons. No organization can have too many creative employees, since a creative employee always produces more than he or she consumes. The real problem is how to organize employees so as to maximize their creativity. This is done by keeping all octets autonomous and having their cooperation always be voluntary and by mutual consent. This process begins at the lowest levels of SEE.

Freedom of Choice

The focus of SEE is to maximize the creativity of its students. In order to do this it must maximize the freedom of creative choice for each student. This will teach students how to be maximally creative and use their quantum connection. It is necessary to trust students' judgment that they know what is best for them and not condition them to believe that they have no say in their education. In order to maximize the choices for the students, we wish to offer students the maximum number of courses within each school. This will obviously be limited in the beginning, as SEE bootstraps itself from just one school.

The evolution of choice will take place as follows: students will at first have only a single SEE school available to them. They will also have available the current public and private school system. SEE network employees and their children will always be given the opportunity to use their scholar-

ships at a school of their choosing. They will not be forced or in any way pressured to attend SEE. They will merely be given the opportunity to do so. In this way there will be a true element of choice from the very beginning in selecting schools.

Within SEE, the students will choose their own track and the courses that they take within the track. All the course offerings of the school will be available to all the students at all times. The students will have the option of skipping the theoretical and just doing the practical, or vice versa if they wish, although the two will be closely integrated. If they wish to specialize they can focus on any combination of the physical, biological, psychosocial, or integrative studies they desire. The student will be free to function as an individual, a member of an octet, or as a member of any other mutually acceptable student team of any size. The students will continuously have their work evaluated on an individual basis by the teachers, so that they know how much and how well they are learning relative to what there is to learn and relative to other students. They will not be judged; only their progress will be noted in a loving way. They will be counseled by their teachers on a continuing basis about which courses will, in the teacher's opinion, maximize their creativity, but in no way will they be pressured to take these courses. They will always be told to follow their own intuition. Each student will normally interact with eight teachers each day. Up to half of each teacher's time will be allotted for counseling with individual students or groups of students and their families. The students will be encouraged to give feedback to the teachers and suggest how to improve the courses. The teachers will be obligated to discuss all these suggestions within their teaching octets and act collectively on them, informing the students of their actions. The students in turn can then give further feedback to the teachers. Students who are dissatisfied with the feedback may go to the school's governing council, composed of two octets made up from the faculty, and urge corrective action.

Students will never be expelled because of poor progress, although such students may be counseled to try alternative schools. Students will be expelled only because they are impeding the progress of other students *and* seem unwilling to remedy their antisocial behavior. Expulsion will only be implemented by unanimous consent of the governing teachers council and a neutral student octet chosen at random.

All students who wish it will be taught the processes of creative transformation and autopoiesis, then be given the opportunity to practice these processes within octets of their choice. Students who choose to work within an octet will normally, by consensus, all take the same courses teach one another, and do group projects together and possibly in conjunction with other octets.

It is predicted that each octet will choose an optimal path through the

curriculum that will maximize its creativity. When students see that they can make much better *individual* progress within an octet than they can without it, they will choose to become part of an octet, so that eventually all students will choose to work within octets. If they do not, we should change the theory of creative transformation. The students and teaching octets in turn will modify the curriculum previously outlined so that the curriculum itself will also become optimized. The final curriculum for any octet of students may be quite different from the one outlined.

The teachers, through the unanimous consent of their dual-octet governing council, will allocate the expenditure of funds for the school. A maximum-sized school with 64 teachers and 512 students may have a mean yearly budget of $5,120,000. Teachers' average annual salaries and benefits will be limited at each school to the average annual salaries and benefits earned by full-time employees of the SEE economic network which supported the schools. The balance of the funds will go to books, laboratories, and other operating expenses. Within the schools the individual teachers will have their salaries set by unanimous consent of the governing council so that the overall budget is balanced.

To provide feedback to the schools and the students as well as help them in making choices, an evaluation octet of four teachers and four network employees—chosen at random from members of the school governing councils and the top-ranked officers of all octets in the economic network supporting the school—will supervise an evaluation of the educational and creative progress made by each student at each school. This information will be made available to all students, all teachers, and all employees of the network supporting the school. The identity of the students will be kept anonymous except for the individual evaluation of each student, which will be made available to the evaluated student. If the creative transformation theory is correct, there should eventually be very little difference in average progress rates for students of comparable tracks and comparable levels at different SEE schools. Insofar as information is available from other private and public schools, the latter should have rapidly declining progress relative to the SEE schools, unless they adopt SEE's teaching methods.

This system should maximize the opportunity for creative choice among both students and teachers. The schools will compete among themselves to attract students by trying to create the educational environment most conducive to maximizing creativity. Any octet of teachers could create a school and expect support from the economic network simply by attracting students from the network. Their only restrictions as a SEE school will be (1) not to have more than 64 teachers and not to have more than 8 students per teacher, and (2) to allow themselves to be evaluated as previously indicated. Non-SEE schools would have no restrictions or need to submit to evaluation. All they would have to do is attract network stu-

dents, and the network would pay the proper tuition per student (perhaps up to $10,000 per year). We should trust students and their parents to make the right choice in a free environment.

SEE itself should be set up as a not-for-profit organization or be fully integrated with the economic networks depending on what will maximize creativity in each environment. Much will depend on the ever changing and ever more unethical tax laws of the United States. It is always better to spend our income on educating ourselves, our children, and our associates than to give it to the government bureaucracies.

The main objective is to integrate the octet networks in such a way that creative transformation, education, and economics are optimally pursued to the best benefit of humanity. Within the context of the evolutionary ethic there is no conflict between our personal best interest and humanity's best interests. Whatever maximizes our personal creativity maximizes humanity's creativity. We fulfill our obligation to humanity by learning, teaching, and creating to the limits of our capability. These factors are better understood within the context of the SEE economic network.

CHAPTER 7

An Economic Alternative

All current economic systems are inherently self-destructive because they all have as their optimizing criteria something other than maximizing creativity. In communist countries, regardless of their stated goals, the entire society is structured to maximize the power of the Communist party and its leaders. Gorbachev's reforms were tolerated only because it was argued that they would make the Soviet Union stronger. The control of the Communist party was supposed to be preserved, although clearly not all the bureaucrats believed this. There were no other optimality criteria. In order to maintain power, most forms of communism eventually destroy, *all* the creativity of their people. This is particularly true of Soviet communism, which controls some of the most creative nations on earth. Chinese Communism may become different, but I personally believe that it will eventually revert to something as destructive as the traditional Soviet pattern in which all negative feedback to the system is destroyed, and creative, individual initiative is punished. This is the case because the concentration of power over others inevitably destroys. I hope I am wrong and that the Chinese as well as the Soviet communists continue to loosen their control over their very creative people. As we have seen, no mixture of socialism and democracy is viable in the long run. Only an Ethical State is viable. It is not impossible for a communist society to mutate into an Ethical State.

In democratic countries there are more complex structures, with conflicting special-interest groups. In spite of democratic ideology, all democratic countries constantly sacrifice freedom for the *promise* of security. Each special-interest group wishes to maximize its power at the expense of other special-interest groups. Most of the special-interest groups are bureaucracies, e.g., political parties, corporate monopolies (usually closer to oligopolies), or government agencies. They believe only in zero-sum games, where one person's gain is another person's loss. Creative organizations know that through creativity it is possible to create more than is consumed. But these organizations are a decreasing minority whose surpluses are constantly being extorted with the consent of the democratic majority

by the bureaucracies which in turn destroy the creativity which keeps them alive. The bureaucracies control the democratic majority by taking the surpluses of the creative minorities to buy propaganda with which to deceive the electorate. Then they consolidate their positions by redistributing the surpluses to the less creative majority after taking a substantial commission for themselves. This is how all bureaucracies destroy themselves. Therefore, no combination of socialism and democracy will avoid self-destruction, although some forms destroy themselves more slowly than others. Only an ethically based libertarian society, an Ethical State, is viable in the long run. Capitalism works only insofar as it is also libertarian. Democratic capitalism leads inevitably to to socialism. Socrates knew that 2,400 years ago, although Marx missed the point.

The problem is not how to create an alternative to democracy, capitalism, and socialism, but rather how to begin creating an alternative in the midst of a world economic system that has irreversible entropy. In order to do this we must first understand the nature of "wealth."

Wealth

Wealth is anything that can be accumulated and exchanged for the products of creative labor. *Creative labor* is any labor that produces any goods or services that can in any way be used to enhance anyone's creativity or intelligence, i.e., ability to predict and control the total environment. Only creative persons can produce creative labor. Since $C = IE$, creative labor increases intelligence, ethics, or both. Wealth can be accumulated in the form of (1) defendable and controllable natural or manufactured resources, including knowledge, (2) commitments by creative persons to labor on one's behalf, or (3) money. Money is a symbolic representation of alleged units of creative labor which has value only insofar as persons are willing to exchange creative labor or resources for the money. The key to wealth, therefore, is not money but creative labor. Natural resources are of little or no value in themselves unless they are used to fuel creative labor. Natural resources without creative labor have even less value than petroleum has without fire or heat engines.

Uncreative persons are, by definition, destructive persons, since trivia is a set of measure zero. The cost in wealth of interacting with destructive persons is always greater than any profit in wealth that one might obtain from the interaction. In other words, destructive persons (when $0 > E \geq -1$), even when they are capable of creative labor, will by definition produce more destructive acts than creative acts, so that they will decrease the wealth of anyone with whom they freely interact. Destructive persons can only accumulate wealth by exploiting creative persons and in some way forcibly taking it away from them. To exploit a person is to interact with the person in such a way that we decrease his/her wealth. When two crea-

tive persons interact they both end up with more wealth than when they began, even if this wealth is entirely in the form of knowledge and it is unevenly distributed.

A general theorem is that, when persons interact, the least creative receives the greatest benefit or the least damage if they are both destructive. If they are both creative, then the most creative also receives a benefit even if it is less than the other's, but no one's wealth is decreased. This is a form of natural, ethical communism by which the wealth of all creative persons is both equalized and maximized in the long run. In conventional (Leninist) communism, wealth is minimized and unequally distributed. In the long run only poverty is distributed under Leninism.

Corollary: We are each ethically obligated to interact with the most creative persons we can find, but we should never fear interacting with anyone so long as we emphasize ethical information exchange, i.e., we emphasize maximizing each other's ethics.

Therefore, if we are to maximize our wealth we should maximize the number of maximally creative persons with whom we interact and minimize the number of destructive persons with whom we interact. This is true whether we are destructive or creative.

The greatest and most secure form of wealth that we ever accumulate is our own creativity. The only form of wealth which is not necessarily destroyed by interacting with destructive persons is our personal creativity. This is true if and only if we love our enemies, i.e., destructive persons. If we respond to our enemies with anger or hatred, then, through fear, we decrease in creativity by decreasing in ethics.

There is nothing we can do that will do more to reduce our fear and increase our ethics than to love our enemies. Recall that a current enemy is any person who is currently destructive. Ethically, we are constrained to love our enemy, i.e., increase his or her creativity, solely by helping him or her increase his or her ethics. If the person is truly an enemy, our love will drive the person away from us, while increasing our ethics. This is part of the cosmic quarantine. If the person is not an enemy, but an ethical person merely behaving unethically, our love will be reciprocated and that person will increase our ethics and our wealth as well as his/hers. In other words, ethical love can only increase wealth and never diminish it, because ethical love will always, as a minimum, increase our creativity by increasing our ethics. Insofar as the person we love is also creative, love will also increase our intelligence directly or through another form of wealth. If the person we love is ethical and it is our imperfections that drive that person away when we try to love him or her, both our intelligence and our ethics will have been increased (our intelligence by making us more aware of our imperfections). Therefore, we never fear interacting with anyone and use creative transformation to choose our friends. Remember, it is always unethical to judge the ethics of another person. We judge acts, not persons.

From this it follows that only by seeking to maximize creativity will we maximize our true wealth, which is our personal creativity. Trying to maximize wealth directly may get us a lot of money but it will not maximize our true wealth. Indeed, persons who equate money and wealth are invariably driven by fear. When they have no money they are afraid because they have no faith in being able to create what they need. When they have money they are even more afraid that they are going to lose it. Their mindset forces them to accumulate more and more money to protect the money they already have until they die loveless and totally uncreative. As Jesus said, *"What does it profit a man if he gains the whole world and in the end loses his own soul?"*

To lose our creativity is to have lost our soul by closing our quantum connection to God. Creativity is the only true, lasting wealth. It is a wealth we maximize by giving it away rather than hoarding it. Those who are already creative shall become more creative through our love. Those who are uncreative shall be driven away by our love and become even less creative. *"For whosoever hath, to him shall be given and he shall have more abundance: but whosoever hath not, from him shall be taken away even that he hath."* (Matthew 13:12)

Ethical Economics

Any economic system which is not self-destructive must be based on the notion of maximizing creativity for everybody rather than on maximizing, with or without constraints, any other concept of wealth for anybody. Creativity is the only form of wealth that the more we distribute it, the more everyone has. Therefore, the true economic problems to be solved are: (1) How do we interact with others so as to maximize their creativity? and (2) How do we select with whom we are going to interact? If we solve these problems, the solution to the problem of how to acquire the resources we need falls out as a trivial by-product. If we are maximally creative we always have the resources we need to keep increasing our creativity and that of others at the maximum rate. Everyone who plays the Game of Life wins.

All these problems have a common solution. The solution is creative transformation. If we do our best to engage in creative transformation, we automatically maximize our creativity and that of those with whom we interact. To do our best to engage in creative transformation is to follow the eight steps previously given (pp. 268–70; 276). We are ethically obligated to create an octet around us or to join an octet that someone else has created, unless we have discovered a better form of creative transformation. We do not have to limit ourselves to a single octet. Being part of at least one octet may be a necessary condition for creative transformation. It may not be sufficient. The eight steps are a sufficient condition for creative transformation; there may be other sufficient conditions. The optimal conditions

for creative transformation will involve variations on the eight steps that will be different for each person. Like all creative processes this will be self-catalyzing.

By engaging in creative transformation you will each understand how to optimize it for yourself. There are an infinity of paths between us and the Moral Society. Each person must discover for him or herself what is the best path. I will here give you one out of an infinity of paths. Those of you who wish it are welcome to join us on it; but do not be afraid to explore other paths with other persons. The more you explore the more likely you are to discover the path that is optimal for yourself. The path of SEE may be in error. Together we can correct our errors. If we do not help correct each other's errors, we all fail. The only danger is self-deception. This danger can be eliminated by ethics and scientific method.

A Personal Path

For me the first four steps for engaging in creative transformation are absolutely essential. If I had not done my best to take them, I would not now have been able to take the fifth step, which involves becoming self-sufficient within an ethical context. Intuitively I have known since 1971 that self-sufficiency was important. Many others perceive the same need. Yet we all fail in this endeavor because it takes more than one family to make a self-sufficient community. Communities integrated by anything other than the evolutionary ethic and the creative transformation process are doomed to fail and eventually succumb to either predatory capitalism or socialistic confiscation. That is why so many American farmers are going bankrupt. Farming communities are the closest approximation we have to self-sufficiency.

Farmers value their independence so much that they are willing to take great risks and work extremely hard for very little money in order to maintain it; yet they are failing by the thousands because their priorities are wrong. The most important self-sufficiency to achieve first is not in housing or food, but in education. It is our ignorance that makes us poor. Dependence on the educational bureaucracy is worse than no formal education at all. We can always educate ourselves.

Self-sufficiency is extremely important because so long as we are a part of the larger economy we cannot avoid increasing the wealth of destructive persons. Every time we attend or send our children to the educational bureaucracy we strengthen that system and contribute to the destruction of the creativity of others and our own. Yet the educational bureaucracy has the knowledge we need to create an educational alternative such as was presented in the previous chapter. The creation of such an alternative requires a critical mass of creative talent to form the teaching octets plus a certain minimum of material resources. The process of creative transformation automatically links us to the creative talent necessary to

create SEE. It also opens new economic opportunities which automatically provide the resources necessary for the school. These resources autonomize us from the current destructive educational and economic system. We need only have the courage to take these opportunities as they are presented to us. We must learn to become economically independent of the bureaucracy or we will not become creatively transformed. Although the belief that we cannot love creatively is the most difficult fear to overcome, the belief that we cannot create the means for our own survival is the first fear we ever conquer. Many persons can never go beyond this fear. They cannot even begin creative transformation.

All wealth comes from creativity. The human species is continuously depleting its readily available resources and being forced to create new technologies to utilize the resources that remain. We have increased our obvious material wealth over the centuries solely through creativity. First our hunting-gathering ancestors depleted the readily available food supply. Then our ancestors developed group hunting to compensate for this but depleted the big game. Then they developed the spear thrower but depleted smaller, fleeter animals. Then they developed the bow and arrow but depleted the most wily game of all. Then they developed herding technologies but depleted the natural pastures. Then they developed agriculture but depleted the soil. This forced them to invent ever newer agricultural technologies, from fertilizers to plows and irrigation, to use what was left, as well as food processing and other technologies. These technologies led to such an enormous increase in the numbers of humans that soon there was not enough land for everyone, or so it was perceived. Humanity has been in constant warfare for thousands of years, and even today, over territorial rights. Each culture survives only by constantly (1) innovating or borrowing innovations to squeeze new livelihoods out of the remaining resources and (2) defending itself from the more predatory cultures who want their territory and/or wish to control their people. This process has now brought us to the point of nuclear annihilation, although the nuclear threat has somewhat lowered the actual warfare to be expected under the current realities.

We now need a radical, psychosocial innovation which eliminates the need for war as a means of maintaining natural selection among ourselves. No nation is going to allow itself to be destroyed if it has a chance of preventing that through the use of nuclear weapons. The complexity and cost of nuclear weapons *alone* have kept them from spreading to every nation on earth. By and large it is the least creative nations that are incapable of producing nuclear weapons. The most creative nations all either have nuclear weapons or have the capacity to quickly develop them. However, as technology transfer from the most creative to the least creative nations continues along its inexorable path, soon every nation—even the most evil and destructive societies, such as those resulting from despotic, totally uncreative dictatorships in the Middle East, Asia, Africa and Latin

America—will also have nuclear weapons. With hundreds of fingers on the nuclear trigger, nuclear annihilation will be almost impossible to avoid. The only way to prevent the impending holocaust is to deny evil, uncreative persons access to the creative talent that gives them *all* their power.

The most ethical way to deny evil persons access to creative talent is to have an alternative way of life available that will be so attractive that creative persons will choose it in spite of all apparent risks and hardships. This alternative is a self-sufficient, libertarian community engaging in creative transformation. One way to create such a community is as follows:

We can neither teach what we do not know nor lead where we do not go. Each of us must in time be prepared to serve alone as a nucleus for creating an ethical, libertarian, self-sufficient society engaging in creative transformation. It is always best to join other societies that share our values if they exist. It amplifies our personal creativity. We hope that you will consider SEE such a society; but if you do not, you should create your own society just as we have. Remember, SEE and I may be in error. The price of innovation is to risk accidental self-destruction through self-deception. If you want something and it does not exist, you create it. If you wait for someone to create it for you, you will probably wait forever. Thus, if neither SEE nor any other society meets your ethical requirements, you begin with yourself. The first step is to educate yourself as closely as possible to the equivalent of completing the thirteenth level of the SEE program. This is very difficult within the educational bureaucracy. You can only do your best. If you do your best, you always win the Game of Life.

Simultaneously with this process you create one or more octets around yourself to whom you can relate as equals and who give you constructive feedback. An octet that gives you no negative feedback is useless to you, unless you believe you are already perfect. In the latter case you are useless to yourself.

Independently of your octet(s), if necessary, although it will be easier if others cooperate with you on this, gradually but surely break away from the bureaucracy and go to work for yourself. In working for yourself do the most creative work you can think of. If that does not enable you to support yourself at an acceptable standard of living and meet your obligations to others, then do the next most creative thing you can or the next most creative until you can maintain a minimally acceptable standard of living. Try to ignore the profitability of your enterprise as much as possible and focus on your creative output. Creative self-employment is an extension of our quantum modality into the economic sphere. In general, follow these eight personal, economic principles to the best of your ability:

1. Maximize creativity while ignoring future security: income is considered only as it affects future creativity, not security; this is difficult. Simply do your best.

2. Do not hoard money or resources out of fear for the future; use what you have now to maximize creativity now and in the long run; the future will take care of itself if you maximize creativity in the present while projecting the creative consequences of your actions as far into the future as possible; regard money as a resource for increasing creativity not as a means for security; the latter is an illusion.
3. Focus on what is most creative for all, not just yourself.
4. Openly share information with all ethical persons, do not hoard it; at the same time, give no alms, but engage in fair exchanges for your time and resources.
5. Do not work directly or indirectly for or with persons or organizations that are in any way systematically destructive to themselves or others; be distant but friendly to such entities, giving them only relevant feedback for reducing their destructiveness.
6. Give first priority to maximizing the creativity of your family; do not sacrifice yourself or your family for others, but try to maximize the creativity of all.
7. Give second priority to maximizing the creativity of your octet(s).
8. Give priority to maximizing the creativity of others in inverse proportion to their distance from your immediate octet(s) and network; it is difficult to have close personal relationships among more than four families; if you maximize each other's creativity while behaving decently, you maximize creativity for all humanity.

You should eventually be in at least one octet in which everyone in the octet lives by the same principles. They are (1) educating themselves, (2) doing their best to be maximally creative, and (3) self-employed either alone, in conjunction with you, or in conjunction with others. Do your best to work only with persons who share your values and your goals both as associates and clients. Never take an associate who does not share your values and your goals even if it means working entirely alone.

Only if it is absolutely necessary to survive economically should you work with clients who do not share your goals or values, even though they may be ethical. Always give preference to clients who most closely share your values even if it means minimizing your income to the lowest acceptable level. *Never, under any circumstances, knowingly cooperate with or aid any potential client or associate who is engaged in any way in a destructive enterprise.* Be uncompromising in this even if it appears that lack of cooperation will lead to economic or physical disaster for you. This last possibility is almost always an illusion, induced by fear.

When you and the other members of your octet(s) feel ready, begin creating your own version of SEE. Do this by pledging a given percentage

of your income and/or your time to the creation of your own school. Those of you who feel competent to create the school on your own, do so. If none of you feels competent to do so, use your contributions to hire by consensus at least one person to serve as the nucleus for the teaching octet that will build the school. As you all grow economically—and you will if you follow this path—increase your contributions to the school until you have a full-time teaching octet devoted to building the school. Set the school up as a not-for-profit organization, or integrate it completely into your economic networks. You and all contributors to the school should organize your businesses and your estates to continue to endow the school with scholarships for yourself, your employees, and for your children to attend the school, or another school if they prefer, even if this is on a part-time basis. Since you are collectively creating the school, it should provide the kind of education which is not available elsewhere and which maximizes creativity. Therefore, you, your associates, and your children will almost always prefer to attend the school that you are helping to create. If a more creative school exists, merge with it and learn from it.

In attending and creating the school, you, your employees, and your families will become more creative, and your businesses will become more profitable.

Once your business consists of a full octet, use part of your surplus income not to grow in a conventional way by simply hiring more employees, but rather to create new affiliated, partially independent businesses which supplement your capabilities and provide you with the additional goods and services that new employees would have provided. Your original business does not directly manage the new affiliated business, but rather is an investor in the new business, owning an equitable share, having at least one male and one female of the original octet sitting on the board of directors of the new business, and providing the employees of that new business, which should not exceed an octet, the opportunity to buy out the interest of the original octet under equitable terms. Each business is therefore based on an octet which sets up other businesses based on an octet.

The members of each business octet own all the stock in that octet once they have bought out the stock of the octet which helped create it. At that time they are completely independent. They can follow their own chosen pattern of growth or create new subsidiary business octets of their own. If the theory predicts correctly, eventually the main business of every octet becomes the creation of new, creative, economic octets—each one slightly different, innovating and improving the pattern of its creators. At the same time there is a rapidly growing economic network of small, creative companies, all dedicated to and guided by common ethical principles and goals. They provide an ever expanding variety of goods and services for the network and the schools the network supports. As they become fully autonomous, each economic octet may deviate from this pattern if it wishes and

create its own schools or simply devote itself to growing and enriching itself like any other capitalistic enterprise. The companies that follow the most creative path will attract the most creative persons. The networks to which they belong will eventually be able to attract most of the creative persons in the world by providing them with the best opportunities to be creative and independent within an economic or a teaching octet of their choosing. Research and development will be carried out by the teaching octets and economic octets devoted to more immediate applications. Networks of economic octets may also choose to support long-range, pure research in any area as a way of maximizing their collective creativity.

Therefore, a single, autonomous economic octet can begin a network by creating a single school and then spinning off new economic octets as well as new schools as its creativity and its wealth increase. Each economic or teaching octet it spins off makes the original economic octet more creative and wealthy. The schools and economic octets that are spun off are a reflection of the original octet that created them. They have a common set of goals and ethical codes, and in many cases personnel that came from the original octet and decided to try something new within a new octet. These components collectively constitute the genetic code of the octet network.

As each octet becomes totally autonomous of its parent it may mutate in new directions and become either more creative or more destructive. If it becomes more destructive and does not correct this trend, then the octet will destroy itself by not being able to attract students or creative contributors to its programs. If it becomes more creative, it will serve as an example to other octets to improve themselves, and in the meantime this octet and its network will attract the best students and creative contributors. This is, of course, completely analogous to natural selection, with the selection criteria based entirely on creativity. It should in time lead to a Moral Society. The process has already started, but is far from perfect and may even have serious, destructive errors.

Each creative person, as of this instant, has an option either to start his/her own octet and create a network or to join an existing network and be incorporated in a new teaching or economic octet created by an already existing octet. In the latter case, the octet in which the person starts—although he/she will eventually have an equal voice in consensus with seven other persons—is not entirely of his or her creation, but it represents an easier, quicker step for many persons than creating their own network from scratch. Many fine, creative persons find creating their own job the most difficult task of all. We can all be creative but we cannot all be equally entrepreneurial. It is a goal of SEE to help persons become creative entrepreneurs and/or teachers within an octet that complements their skills and inclinations, or alone if they prefer.

As the network expands there will be an ever expanding number of new economic and teaching octets, each one different from the others.

Therefore, nonentrepreneurial, creative persons will have ever expanding sets of options for themselves. However, I strongly encourage independent-minded persons with even the slightest entrepreneurial streak to start their own octet and network. Almost anyone can do it, if he/she is not too afraid.

Specific Suggestions

The advantage of limiting organizations to eight persons is that, besides maximizing the creativity of the organization's members and minimizing their danger of becoming corrupted by power, it allows the organization to keep a low profile, while the network itself is all but invisible to outsiders. This will hopefully minimize the fear of corporate and government bureaucracies, which are the natural enemies of any ethical enterprise not under their control. In fact, this type of organization and networking is even possible in many communist countries as they become increasingly forced to allow free enterprise lest they collapse economically. However, it will be easiest to implement in capitalistic democracies in general and in the United States in particular. Societies in which radical educational innovation is no longer possible, because of absolute, tyrannical control by government bureaucracies, already have irreversible entropy and probably cannot be reformed without revolution.

The United States probably has more entrepreneurial opportunities and is more open to educational experimentation than any other nation. Millions of legal and illegal immigrants, most of them penniless, without a knowledge of English and poorly educated, come to the United States every year and eventually start businesses of their own. Indeed, the poor, poorly educated immigrants without readily marketable skills are as a group far more entrepreneurial and eventually earn higher incomes than many native-born Americans. They do this because their high intelligence combined with a lack of skills and knowledge relevant to conventional employment forces them to become self-employed.

The American economic system, in spite of all its corruption, is still heavily biased in favor of the self-employed entrepreneur. This is a fortunate but eroding relic of the libertarian ethics of the Founding Fathers. Unless we succeed in creating an Ethical State, this will probably not last much longer. The 1986 tax "reform" law together with lingering "Reagonomics" will favor established monopolies and inhibit new, creative enterprises. The Democratic party is just as destructive in this regard as are the Republicans. Therefore, I encourage everyone who wishes to create an Ethical State, either in conjunction with an existing SEE network or by creating his/her own SEE network, to come and do it soon in the United States; the current opportunities are rapidly vanishing as the U.S. government confiscates an ever greater part of the wealth of its most creative citizens and gives it to its least creative citizens, as in other socialistic nations.

There is already so much bureaucracy in the United States that almost anyone willing to work hard and honestly in any creative endeavor can start his/her own business. For example, completely uneducated persons with almost no knowledge of English can immediately create their own business in most cities by simply providing house cleaning and janitorial services. Almost all native-born Americans with only these low skill levels prefer to live as welfare parasites or as employees of corporate, legal, and government bureaucracies. Bureaucracy is the welfare system of the middle class. These unfortunates have no confidence at all in their creativity or their intelligence.

If you have a few more skills, there are even more economic opportunities in providing gardening, handy-person, mechanical, office, tailoring, restaurant, or similar services to an increasingly specialized population that can no longer even take care of their own basic needs. Finally, if you have professional-level skills in almost any area you can easily create your own business by selling your services directly to the public, providing tutorial services to students or creative services as a subcontractor to existing American enterprises. The latter are often so inefficient that independent, creative professionals can earn an excellent living in their own business while providing services to these larger organizations at much less than the cost that these organizations can provide services to themselves. I have been supporting myself this way as an applied mathematician and systems engineer since 1970, when I sold my first business and decided to focus my life on creating an Ethical State. I personally have learned that inventing new products and services, developing prototypes, and then selling patent and manufacturing rights to these is better than consulting or mass production.

Whatever your educational or economic background, if you are at all creative, you have valuable skills that can be sold on the open market to start you on your way to economic independence and your own SEE network. In the process, you may just need a little help in the form of a few, not more than seven, partners. Those whose major skills are psychosocial can be independent by offering your skills to technically creative persons with weak psychosocial skills. Your help can be in the organization and administration of their businesses plus the marketing of their products and services. In this way you can become part of many creative enterprises.

Therefore, you can take the best creative skill you have that has any commercial value and create a business around it or join an existing SEE network and let them help you create an economic octet around your best skill in exchange for a percentage of your business. You and your octet can later repurchase this outside percentage and completely control your own business. Once this is achieved you may start your own school if you wish or contribute to an existing SEE school by giving yourself, your employees, and your children scholarships from your business to attend the schools of their choice. This last activity is very important; it will enhance your busi-

ness and its ability to generate spinoffs. Always set aside as large a percentage of your profits as is feasible to educate yourself and those you love outside of the academic bureaucracy. This maximizes both wealth and creativity.

Once you have a full economic octet, are profitable, and have begun giving scholarships to your employees (who should become your partners) and their families, you take the most essential service or product for which you are a consumer and which can be provided by a small business within your means, and create an economic octet to run this business. A good way to do this is to use a consensus to take half of your octet to form the nucleus of the new business and run it while each quartet retains a 50% interest in each other's business. Then you each recruit new members for each other's octets and let each of the new octets buy out the other octet's interest in their business. This splitting approach to creating new economic octets also applies if your original business is growing so fast that you have to hire more employees to keep up with the demand for your octet's services and/or products. In this case you would split the original octet in two by consensus and then create two new economic octets from each quartet to handle the business of the old (parent) economic octet. Ironically, these procedures, which are creatively optimal, are also in harmony with both the antitrust (antimonopoly) laws in capitalist countries and the anticapitalist laws in communist countries that are now opening their systems to free enterprise, in order to avoid economic collapse.

The first communist countries which permit this type of capitalism to operate in *all* sectors of their society will achieve a rapidly growing economic advantage over all other communist countries as well as some capitalist countries. This will be achieved without in any way having to deviate from the basic goals of communism of guaranteeing economic security to everyone or giving up the political monopoly of the communist party. The recent developments in the Soviet Union and other communist countries are in this direction, but they still have a long way to go.

The only reason a communist party might not allow this liberation process to continue is that it would fear losing control of the people—which it will. This is what happened in Hungary in 1956, in Czechoslovakia in 1968, and in Poland in 1980 and then extensively in 1989. The capitalistic bureaucracies may also fear the process for the same reason. Once persons lose their economic fear, they become very difficult to control by any destructive organization. When they have lost all their fear and learned to love their enemies, they are impossible to control. They can then only be rationally and ethically persuaded to cooperate with others.

Problems and Solutions

Both capitalistic and communistic societies control the masses by lies and manipulation of their fears. This process is merely easier to implement in a

communistic than in a capitalistic society. In democracies, lawyers and politicians have to be highly skillful liars to succeed. But nobody ever lost a legal case, money, or an election by underestimating the intelligence of the democratic masses, to paraphrase P.T. Barnum.

The last way in which ethical persons are ever manipulated by unethical persons is when the latter use fear and hatred toward enemies to control them. However valid our assessment of our enemies' destructiveness may be, we merely decrease our creativity by fearing and hating them. This process is something that political bureaucrats understand very well. Almost all governments use fear and hatred of foreigners masked as patriotism to control their subjects.

The best protection of the creative transformation process in the United States is that those who manipulate the population by lies and fear will be much more afraid and preoccupied with each other than with a system that works entirely within the letter and the spirit of the laws of the United States, never lies, and in which autonomous organizations are never much larger than eight persons. Hopefully the projection of their own fear onto others will prevent them from seeing the potentially liberating effect of creative transformation through voluntary cooperation. Persons with high levels of conflicting fear cannot voluntarily cooperate with each other or imagine that it might be otherwise. Common fear can only unite persons in common destructiveness, as has always happened in nation states.

The main problems for the octets will not come because growth is too slow but because growth is too fast. When they grow too fast they may feel compelled to spin off subsidiary (daughter) octets too soon with too little input from the parent octet. The danger here is that they will create businesses and give them to persons who have not been adequately prepared and who will use the business for destructive purposes. The best way to prevent this is to: (1) spinoff not more than four daughter octets at any time; that is, do not spinoff more octets than can be closely supervised by at least one male-female pair from the parent octet; (2) hire on a temporary basis only those who have gone through the creative transformation process and become part of an octet; (3) permanently hire only those persons who have been in a creative transformation octet for extended periods of time and are unanimously recommended for the job by all other members of their current octet plus all members of the parent octet; and (4) ensure that permanent employees slowly but surely acquire stock or a percentage interest in the daughter octets until they each own an equitable part within eight years. The first key employee of the daughter octet should have the most essential key skills and may end up with more than one eighth of the octet ownership, but probably not more than one fourth. Octets in which anyone's labor is worth more than four times another octet member's labor may not be socially or economically optimal. Each octet member must be treated fairly, without exploitation or special privileges.

My own experience is that the second step above, as it has now been refined, will eliminate about 90% of the destructive persons who might join the octet solely for economic security; the third step will eliminate almost all of the remaining destructive persons. They will not be able to hide their fear simultaneously from their own octet and from the parent octet for an extended period. Persons who are not accepted in economic or teaching octets should be encouraged to remain in creative transformation octets and to continue the creative transformation process, but they should not be hired permanently until they have lowered their fear by ceasing to be objectively destructive in their behavior. We each have the moral duty to help everyone we can to lower their fear.

Those who are not hired but remain in the creative transformation process should be hired as soon as their octet and the parent octet decide that their destructive behavior is sufficiently low that they will add to and not detract from the daughter octet. In the meantime they can do consulting or contract labor for the network, where an interdependency is not necessary. This means that independent octets will at first grow very slowly until they are part of a network for recruiting employees for daughter octets. In order to grow creatively each octet will have to continually invest resources in teaching creative transformation to the general public and creating new octets solely for the purpose of continuing creative transformation. This is where the creative transformation network can be very useful.

Investment in Creative Transformation

In Chapter 5 we saw that creative transformation is an end in itself. It is worth investing in solely as a creative act because anything that increases anyone's creativity benefits all humanity, including us. The most creative thing we can do for ourselves is to help another person become more creative. For this reason SEE has a program for continuously teaching creative transformation to others at no charge. We should not charge others for benefiting ourselves even if we benefit them in the process. By charging for a basic act of love we corrupt our love and decrease our creativity and that of others. Ethical love cannot be bought or sold. However, we do get an indirect economic benefit out of creating a creative transformation network independently of the schools and the economic octets.

Each creative transformation octet is a potential source of recruits for our teaching and economic octets. These are recruits that are already ethically prepared and readily available to be hired by our schools and our businesses. Therefore, from a purely economic point of view they are a worthwhile investment and should be seen as a personnel expense for our octets that can in the long run save considerable expense and time in helping our network grow optimally. We want to promote the maximum creative growth of all octets and networks, not only those with which we are

directly affiliated. At the same time we wish to help all creative persons become more creative by becoming economically independent within their own octet: it is in our own enlightened self-interest to do so. We will therefore help any octet or network which appears to share our values, but may differ with us on details, to hire persons from our own octet or network.

Whatever maximizes anyone's creativity is in the best interest of all. If a valued associate of ours believes that he or she would be more creative in another octet or another network, we want them to do what is best for themselves because that is what is best for ourselves. This will serve as a source of negative feedback for us and help to maximize the collective creativity of humanity—which is the only ultimate goal.

For this reason we will help the octets and networks recruit personnel from our network even if they do not reciprocate. The economic return will come later and indirectly, just as it does from teaching creative transformation to others at no charge. I hope that all octets and networks recognize this and reciprocate by facilitating recruitment of personnel throughout their creative transformation, teaching, and economic octets. It is in their own best interest. However, if we are to be self-sufficient we cannot depend on others and must, as a minimum part of any octet, have an ongoing program of setting up creative transformation octets. A business or a school can presumably invest more in creating creative transformation octets than can the creative transformation octets themselves.

In the teaching and economic octets we must be careful to recruit personnel who use our resources most creatively. But in the creative transformation octet, which has no extrinsic rewards, we can be much more bold since the process is self-selecting. We accept all who wish to participate in the process and let them select themselves in or out. Those who do not select themselves out will in time become creatively transformed, and in the process become a potential, valuable ally to us. Each octet should set aside a percentage of its resources to recruit and teach the creative transformation process to members of the general population and help them join an octet of their choosing. It should not charge for this service, but see it as a long-term investment which is both an end in itself as well as a potential source of future associates. Educational and economic octets can do this by running the following—or similar—advertisement in a local newspaper and then teaching creative transformation to those who apply:

LEARN—TEACH—CREATE

Immediate openings from apprentice to Ph.D. professional level for those with high creative potential in Science, Technology, Art, Crafts, Trades, Communication and Administration. We offer outstanding opportunities for you to be maximally creative. For detailed application, call or write:

School of Experimental Ecology
P.O. Box 10851 • Eugene, Oregon 97440 • 503/937-3437

We then answer all persons who answer the advertisement with the following (or similar) cover letter:

Dear Applicant:

Thank you for your interest in SEE. Briefly I can tell you that we are a secular Scientific-Educational-Economic cooperative with the sole goal of maximizing creativity for ourselves and for others. We hope that you join us and work with us.

In order to make sure that you understand who we are, how we operate, and whether you would like to work with us, we offer you the opportunity to participate free of charge in a three-day seminar and workshop with other applicants. During the seminar we will also provide you with room and board at no charge to you. The seminar involves learning a new, still experimental, technique that we have developed for enhancing creativity. Since this technique is a central part of our teaching, working, and operational methodology, we wish to make sure you understand it and are comfortable with it before we hire you.

If you understand and are comfortable with the technique and share our values, we may offer you a position paying not less than $100.00 per month with room and board for a full-time apprentice to not more than $2000.00 per month with no room and board, but with generous equity and profit-sharing based on your own contributions, for a full-time, high-level professional with skills we currently need.

Since our personnel needs and economic condition are constantly changing, the positions currently available at SEE may no longer be available when you are hireable, but other positions may open at that time. After being employed with SEE over one year, all full-time SEE associates and their immediate family are eligible to receive excellent conventional fringe benefits plus full scholarships for each dependent to attend the school of his/her choice. These scholarships include guaranteed admittance for applicants and/or their family at one of our affiliated Schools for Evolutionary Education, when available, where all the Sciences, Humanities, Arts, and Technology are taught as a single unified field, tied together by a generalized theory of evolution, in such a way as to maximize creativity. These studies range from pre-kindergarten to the post-graduate level.

Before you register for the seminar, we require that you read and understand a book that covers the material of the seminar. This book, Creative Transformation, *is available to you through most libraries and bookstores. If you cannot find it, we will lend you a copy at no charge. When you feel you understand the book and are ready to take the seminar, please fill in the enclosed application and send it to us. At that time we will interview you to make sure you have understood the book, and are ready for the seminar. If you have trouble understanding the book we will tutor you at no charge until you understand it. Then we will admit you to the*

seminar and workshop. The seminar will begin in the afternoon. It will include an intense four-hour audiovisual summary of Creative Transformation *with extended group discussion plus question-and-answer periods with an expert creative transformation teacher. That evening you and other seminar participants who wish to remain for the workshop will be our guests at dinner, followed by a group social for all of you to get a chance to know one another. There will usually be at least eight seminar participants but rarely more than twenty-four. There will usually be about the same number of men and women.*

During the next two days you will all participate, in groups of approximately four men and four women, in a series of practical creative transformation exercises designed to teach by solving problems related to maximizing creativity. On the final, or third, day you will engage in an exercise we call "autopoiesis," which means self-creation. This exercise is usually over by five. At that time, or afterward if you prefer, we will integrate you into a group of four men and four women who are continuing to practice creative transformation and autopoiesis on their own. They will meet twice during the following month. If after meeting twice with this group you still wish to work with SEE and you appear to share our values, we will offer you a job as an outside contractor on a 90-day probationary basis. If after the 90 days of probation we mutually agree to work together, we will offer you a junior partnership within an affiliate of SEE, with no more than eight members, in which you will have an opportunity to eventually own substantial equity and share profits in full partnership within eight years by consensus of the other partners.

We look forward to working with you. At this time we recommend that you read and understand Creative Transformation *as soon as possible. Whenever you are ready to proceed with the seminar and workshop we will arrange a starting time for you.*

Sincerely,

John David Garcia
School of Experimental Ecology

This is one way in which teaching or economic octets in a position to employ new personnel can recruit them. They may also focus the ads on more specific skills. Creative transformation octets without employment opportunities should use a different approach to teaching creative transformation. The main difference would be that purely creative transformation octets would not recruit in the newspaper help-wanted columns and would not offer employment. They would merely look for persons to participate in an experimental process for enhancing creativity at no cost to the participants (see Appendix).

By offering employment opportunities, octets will be more prone to

recruit persons driven by economic fear. This problem is ameliorated by offering as the main compensation relatively low starting base income, profit-sharing, and family scholarships. This approach will be in the best interest of all octets. It will enhance the creativity of each octet and provide creative employment opportunities to each person in the United States and, eventually, other countries. It is a creative alternative to the bureaucratic welfare systems that destroy those they claim to serve. Persons who are driven by fear always show it by destructive acts or by responding with anger to negative feedback. They will avoid the octets. However destructive and mistaken the criticism we receive, we will respond to it with love, if we have truly begun to be creatively transformed.

The Greatest Problem

The major problem within the octets will come from their economic success. Economic success leads to the accumulation of wealth, and wealth gives us power over others, particularly over those driven by fear. Any form of power over human beings (personal power) can be extremely destructive to persons who are not yet moral. But it may be that none of us is ever moral except within an octet that is engaged in creative transformation.

We try to minimize this problem by not controlling organizations with more than eight persons and by eventually sharing our power equally with the seven other persons who make up that organization. But the economic process outlined here will lead to ever increasing wealth for each octet if it is followed in the ethical spirit of seeking at all times to maximize creativity and not money.

Octets who pay more attention to money than to creativity will usually end up with neither money nor creativity. If what you really want is a lot of money, do not use this process, since it is a quantum process that only works for those who are engaging in creative transformation in all aspects of their life. What helps the process remain ethical is that the scholarships to SEE, or whatever ethical variant of SEE your octet creates, be an integral part of your octet. The real goal should be to make a maximally creative education available to as many persons as possible by doing the most creative work we can. Money is a constraint, not a goal. In order to keep the process evolving we must keep creating new octets and setting them free from us. Each octet we create represents a risk to us in two ways: (1) We may not recover our investment, and/or more importantly, (2) the octet we create may become destructive. (I have, but not lately, created organizations that have become destructive and are still operating today.) This risk will produce a tendency to be over-conservative. Instead of investing the octet's wealth in continuing to expand creativity for all humanity, an octet may want to accumulate its wealth in the form of money to be more secure. However, this is an illusion. The greatest security for all ethi-

cal persons lies in the maximum expansion of a creative libertarian society, an Ethical State. This maximizes the creativity of all by creating the maximum number of creative alternatives to the current destructive educational and economic system. Creativity is always our greatest security as well as our greatest opportunity.

As each octet expands by creating ever more independent octets to support its activities, it becomes part of an increasingly larger and more complex network, which constantly enriches the original octet but which the original octet neither controls nor can control. The network is self-controlled by the independent ethical actions of all its members and by mutual self-interest. The network becomes part of ever larger, more complex networks in which all the information of the entire network exists at each node, which is an independent octet. The octets play a role analogous to that of neurons in the brain.

Each octet becomes increasingly creative and wealthy or it disintegrates. So long as the growth of each octet is focused on maximizing creativity, the entire network grows in creativity and wealth. If any octet deviates and focuses on accumulating money, it becomes a cancer in the network and can destroy the entire network, just as a malignancy in a single neuron can lead to death of the entire brain. Therefore, the network needs an internodal feedback system to eliminate malignant octets.

Fortunately, this feedback is immediate and obvious. Any octet that becomes malignant quickly becomes less creative and perhaps destructive. By quickly communicating information within the network about the destructive activities of any octet, the other octets are forewarned. They then have a choice as to how to interact with a potentially malignant octet. Some will limit their interactions to the exchange of ethical information; others will take a chance and continue to interact intellectually and economically with the potentially malignant octet. Soon the doubtful octet will be either exonerated or further repudiated, until the octet is either totally excluded from the network, because no other octet will have transactions with it or it is totally reintegrated into the network because those that continued to interact with it found it still creative.

The important thing is that all network members live up to the contract for creative transformation and communicate quickly and concisely to all members of the network their perceptions, feelings, and intuitions about what is going on within the network. This will be facilitated by modern computer-networking technology. The ultimate limit on the size of a network will depend on the ability of all network members to quickly and accurately communicate with each other and to use all the information of the network at each node. When network members can no longer do this, it may be time for the entire network to split into two daughter networks, each with half the octets and half the wealth of the parent network. Each daughter network then reforms into a new autonomous network and begins

to integrate new members into its network from the creative transformation octets and from other networks until it has to split again. This process will continuously revitalize the networks, and add variety to their genetic structure, as it maximizes their creativity. It is a process to make sure that networks remain open to feedback.

Network Feedback

The key to keeping the creative transformation process vital is to keep the system open to all creative feedback. Feedback is creative when its perception enhances the creativity of those who perceive it. Feedback is destructive when it decreases the creativity of those who perceive it. All true feedback is creative and all false feedback is destructive by the definitions of truth and falsehood (see page 3). We wish to optimize feedback and allow the networks to grow to the maximum size leading to maximum creativity. So long as it is not interfering with feedback, size provides economies of scale, variety of resources, and maximum collective creativity. Size may interfere with feedback in two ways: (1) it may eventually become physically impossible for any octet to communicate in any meaningful way with every other octet; and (2) it may eventually become impossible to organize the information from all the octets in such a way that it meets the priorities of all the octets. Some of these problems are inherent in human beings and some are due to technological limitations.

As we have pointed out earlier, human beings have difficulty in communicating deeply and well with more than seven other persons at a time. Groups smaller or larger than eight become more prone to collective self-delusion. The smaller groups have insufficient variety of perceptions. The larger groups tend to become hierarchical and dominated by an elite, almost always a destructive elite that manipulates the majority. That is why the octet appears to be an optimal size for an autonomous organization.

Within an octet each member shares most of the detailed information on the activities of the octet. Within an organization of octets (a network) each octet has only summary information available on each octet in the network, even if it has access to the same computerized database as all the other octets. The summary information comes from the octet in question and from the interaction of other octets with the octet in question. As soon as information begins to be summarized it can easily become distorted by those who summarize it, without malice on their part but simply as a function of their priorities and interests.

There are two ways to minimize distortion and maximize creative feedback within the network. The first is by taking full advantage of computer network technology integrated with mathematical statistics and communications theory—an approach that would be far too technical for this presentation. Instead we will consider the second method for optimizing net-

work feedback—which is an extended version of creative transformation.

Through creative transformation in general and autopoiesis in particular there occurs a sharing of information and a form of feedback within each octet that transcends words, numbers, and other symbols. Autopoiesis is a form of communication by which we directly share our dreams, our hopes, and our highest love with seven other persons. This *direct* form of communication gives a type of feedback that is deeper and truer than any that is possible by any form of classical technology ranging from language, our oldest classical communication technology, to mathematically optimized multinodal computer networks, our newest form of classical communication technology.

Autopoiesis is not abstract. It is direct in the same sense that within our bodies communication among our four biological brains or, more appropriately, between our classical and our quantum brains is direct. Each of these two brains is in fact a system of biological brains and nonlocal hidden variables that directly tie us to God. Autopoiesis is another mixture of classical and quantum communication processes that enable those who are not overcome by fear to know the soul of each member of the octet (including his/her own). Therefore, the problem to solve is how to create a collective autopoiesis among all members of the network without violating the principle that four each of men and women is the optimal group of persons to engage in autopoiesis.

Consider the simplest network there is—one with two octets. How would we optimize autopoietic communication between the two octets? Clearly we might do it as follows: Consider two octets called octet {A} and octet {B}. The eight persons in each octet we respectively designate {A1,A2,...,A8} and {B1,B2,...,B8}, with the odd numbers being males and the even numbers being females. A collective, optimized autopoiesis between the two would then involve the following procedure: First octets {A} and {B} engage in autopoiesis in the ordinary way. Then, at a later date (two same-day autopoietic sessions or even one or two days apart are difficult to take for most persons), {A} and {B} exchange quartets so that we have autopoiesis between two composite octets. These octets could be the following sets: {A1,A2,A3,A4,B1,B2,B3,B4} and {A5,A6,A7,A8,B5, B6,B7,B8}. There are 1,296 possible four-by-four composite octets!

To maximize the collective, autopoietic effect, both of the composite sets could engage in autopoiesis in close proximity to each other and at the same time. The easiest way to accomplish this is for both {A} and {B} to schedule their regular autopoietic sessions at the same time and place. This may not always be possible. If not, then any subset of two males and two females from both {A} and {B} may agree to get together at their mutual convenience and have an autopoietic session. This will provide excellent feedback, but it would not be as close to optimized as the former situation. A completely optimized autopoietic communication between the two octets

would be as follows: Every other autopoietic session each octet would meet solely with itself. In between these sessions a different subset of two quartets from {A} would meet with two different quartets from {B}. If the octets normally engage in autopoiesis every two weeks, then every four weeks there would be the following composite autopoietic sessions:

<u>4th week:</u> {A1,A2,A3,A4,B1,B2,B3,B4} and {A5,A6,A7,A8,B5,B6,B7,B8}

<u>8th week:</u> {A1,A2,A5,A6,B1,B2,B5,B6} and {A3,A4,A7,A8,B3,B4,B7,B8}

<u>12th week:</u> {A1,A8,A5,A6,B1,B8,B5,B6} and {A3,A4,A7,A2,B2,B3,B4,B7}

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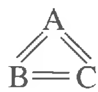
<u>2592th week:</u> {A1,A2,A3,A4,B5,B6,B7,B8} and {A5,A6,A7,A8,B1,B2,B3,B4}

It would take almost 50 years to achieve optimal composite autopoiesis between two octets! Therefore, in network-composite autopoiesis the process will always be suboptimal. The larger the network the more suboptimal it will be. But there are always practical if not optimal ways of achieving composite autopoiesis in a sufficient way for any network. These are as follows:

A Sufficient Algorithm for Composite Autopoiesis

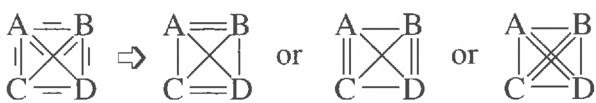
1. In order to preserve its basic identity, a base octet always retains at least two males and two females of its regular octet whenever it engages in composite autopoiesis.
2. The autopoietic communications link always involves the exchange of at least one male or one female from each octet engaging in composite autopoiesis. Therefore, each octet can participate in composite autopoiesis with up to four other octets simultaneously.
3. The entire process is analogous to the combinations of carbon atoms, except either protons or electrons can be exchanged at one time but never more than four total of both. Carbon atoms only exchange electrons. The females in the octet are the analogues of the protons and the males of the electrons (or vice versa, if you prefer). The analogy is in that both a carbon atom and an octet can form a bond with one, two, three, or four other similar entities at a time and also that carbon atoms as well as octets are equally receivers or/and donors in the process.
4. The parent or coordinating octet serves as the basic integrating octet. If the parent's identity has been diffused among many descendants, then one of the descendants is chosen at random to serve as the coordinating octet for each composite autopoiesis.

5. For two octets (A,B), this interaction is expressed as A$\equiv$B and all its 1,296, i.e. 36^2, permutations.
6. For three octets (A,B,C), this interaction is expressed as



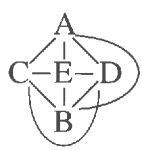
and all its more than 46,656, i.e. 36^3, permutations.

7. For four octets (A,B,C,D), this interaction is expressed as:



and all its more than 1,679,616, i.e. 36^4, permutations with each octet allowed one double bond at random: the half bond.

8. For five or more octets (A,B,C,D,E), this interaction is expressed as



for five; or for an arbitrary number, n:

```
                 etc.
          |      |      |      |
        – A  – B  – C  – D  –
          |      |      |      |
etc. – E  – F  – G  – H  – etc.
          |      |      |      |
        – I  – J  – K  – L  –
          |      |      |      |
                 etc.
```

and all its more than 36^n permutations. Note: $36^5 = 60,466,176$.

END OF ALGORITHM

For the five or more octets, the outer octets in the lattice exchange members until each octet has exchanged two males and two females with four other octets. There will never be an extra outer lattice octet which only exchanges members with three or fewer octets!

Theorem: Once there are five or more octets there is always completion so that all octets may exchange one member of the same sex, two males and two females, with four other octets.

Both autopoiesis within an octet and composite network autopoiesis among five or more octets involve the simultaneous communication by touch of each entity with four different entities. Exchanging members between octets is the network analog of touching.

Each line between octets represents a communication link through exchange between octets of one member of the same sex. A double line or bond represents the exchange of two members of the opposite sex. The preceding eight steps and all their permutations represent a sufficient algorithm for composite autopoiesis for all networks. That is to say, this is an algorithm that will always maintain autopoietic feedback at a minimum acceptable level in all networks. Beyond this, my intuition is that the arrangements of the octets in the lattice should be randomized around the coordinating octet for each composite autopoiesis rather than put through a cycle of cycles through all the possible combinations and permutations trying to optimize the process. In any large network it would be impractical to try to synchronize the time and place of autopoietic interaction for all octets.

The best that can be hoped for is that the coordinating octet will produce a random, sufficient interaction for all octets, notifying each octet of its four composites, and that within four weeks all the octets will have interacted autopoietically with each other as well as within themselves. As the network becomes larger this process will become ever more difficult to complete in a period of four weeks, although octets never need to coordinate their exchange of members with more than four other octets at a time. As the octets within a network become separated geographically, the randomization of octets will become subject to geographic constraints. Eventually many octets in the network may reach a consensus that the time has come to reduce the size of the network in order to have better communication among fewer octets. Those octets that communicate best among themselves will tend to form new networks in affiliation with the old network. An "affiliation" occurs when composite autopoiesis between networks is not systematically pursued, but there is trust, communication, and some autopoietic interaction between the networks. The old network will in effect become a new network once a subnetwork has spun off.

The octets themselves can be self-perpetuating, since they can periodically split in half and recruit new members or replace lost members with

new members. Each octet will be maximally creative if it uses its accumulated wealth to create two new octets from itself whenever it can leave both daughter octets adequately financed. Octets that have complementary creative skills should merge, i.e., exchange complementary quartets, to maximize their generalized intelligence. The most creative octets should leave the maximum progeny. The entire process will emulate natural selection in the best sense of the word. This is evolution without the need for annihilation of the weak. The most creative multiply at the highest rate, but the least creative still multiply at a lower rate so long as they remain minimally creative. Within any network the wealth of all octets tends to equalize. Octets do not necessarily perish unless they are destructive. Octets that become destructive in this high-feedback environment are quickly identified and *de facto* excluded from any economic network because ethical octets will automatically limit their interaction with destructive octets to the exchange of ethical information, e.g., autopoiesis. Can destructive networks of octets be formed?

Destructive Networks

We know that destructive networks are feasible because the world is full of destructive organizations ranging from Islam and Leninist Communism to Organized Crime and the Ku Klux Klan. These are all organizations tied together by mutual fear often expressed in the form of hatred, greed, or both. Organizations driven by fear tend to minimize rather than maximize feedback among all their members. Only the leaders are supposed to know everything that is going on. However, the deliberate annihilation of feedback merely decreases creativity and increases fear still more. Common fear can be a powerful bonding force between destructive persons. Ethically, we cannot hold with the old Arab proverb that *"The enemy of my enemy is my friend."*

Destructive organizations cannot be effective unless they can control creative persons to utilize the wealth which is produced only by creative individuals and organizations. As the number of octets and of networks of octets grows, ever fewer creative persons will be able to be controlled by destructive persons because the creative persons will have an ever increasing number of creative economic alternatives. Therefore, it will become increasingly difficult for destructive persons and organizations to concentrate wealth, however much they may focus on it and however large and collectively intelligent they may be. Destructive persons will eventually be impoverished because they will have nothing to trade that will be valued by ethical persons.

This is why free trade is ethical only among creative persons. Every time that a creative person gives anything other than ethical information to a destructive person, destruction is amplified. Destructive persons and

networks can be eventually eliminated only if all ethical persons refuse to trade wealth with all destructive persons, whatever the apparent advantages. The best protection against unethical trading is established if you: (1) become self-employed as soon as possible; (2) create an octet around you; (3) create a network around your octet; (4) limit your trading as much as possible to other octets within your network or affiliated networks; (5) trade wealth outside of the networks only with persons and organizations who are not engaged in destructive activity; and (6) never knowingly increase the intelligence of a destructive person or organization.

The preceding strategy will maximize the creativity of all ethical persons. It will minimize the destructive potential of all destructive persons and organizations. Although this strategy is designed to optimize the creation of an Ethical State starting with the individual, it also has economical implications for all nations in general and the United States in particular, as the following section shows.

National Ethical Economics

At the national level there may be no creative organizations. To the best of my knowledge all governments, as currently constituted, are destructive. That is why *"that government which governs least governs best."* However, there are creative societies and nations in spite of their governments. The creativity of those societies is due to the freedom that the government gives to its creative citizens. That is why the closer a society is to the libertarian ideal the more creative it will be. All societies seem to be moving away from the libertarian ideal. A few tyrannical societies with highly creative citizens (such as China and Hungary) are individually pressured by obvious self-interest to move toward a freer society, but they still have very far to go. The Russian people are highly creative, but Soviet communism has been terrified of its own people. Even in self-interest they may not come near to Czechoslovakia, Poland, and Hungary in giving more freedom to their citizens, although libertarian reforms are clearly being attempted in the Soviet Union. In every nation the main *de facto* purpose of government is to concentrate power and enrich itself and those who support it by exploiting its most creative citizens, although this exploitation may be cleverly masked as support of socially useful services. This "support" always comes from taking wealth, by force if necessary, from the most creative and redistributing it to the less creative and the destructive.

Just as creative individuals, octets and networks of octets should whenever possible avoid trading with destructive entities to maximize their creativity and (as an almost trivial by-product) also maximize their wealth, so should anyone—including destructive persons and governments—avoid trading with destructive persons and governments. In all interactions the least creative entity receives the maximum economic benefit or the least

damage. Any creative entity can only lose by trading with destructive entities. Therefore, a corollary is that within relatively free nations with unethical governments, such as the United States, creative entities should never trade with tyrannical nations, such as the Soviet Union, in which all trade represents an arrangement between two destructive governments. Trade should be between free, creative entities. Insofar as any of the current governments intervene, they merely degrade the trade to augment their power to destroy. In the case of the U.S. government this degradation may only be slight, since we are much closer to a libertarian society than the Soviet Union. With the Soviet Union this degradation is so great that any trade with the Soviet Union contributes only to the power of the Soviet government to continue to enslave and degrade its own citizens. Insofar as it is possible to trade directly with ethical Soviet citizens, it should be done.

Lenin once said: *"When the time is right we will make great concessions and overtures of peace to the capitalists and they will sell us the rope with which we will hang them"* [707]. Lenin understood capitalists much better than he understood capitalism. He did not foresee that the capitalists would sell them the rope on credit.

The Achilles heel of capitalism is that the capitalistic ethic becomes that virtually anything that one can get away with is justified if it enhances one's wealth. For this reason American businesses ranging from grain farmers in the Midwest to the Chase Manhattan Bank, IBM, and the Ford Motor Company have absolutely no compunctions about trading with the Soviet Union. During the heyday of Henry Kissinger's "detente," American businesses even sold electronic police interrogation equipment to the Soviets. These capitalists are more than willing to sell the Soviets the rope with which they will hang them; they sell it on credit. The selling of arms by the Reagan administration to the evil tyranny in Iran is another example of destructive trade, whatever the true ultimate ends were. Unethical means can never achieve ethical ends.

With a nation such as the Soviet Union, or any other tyranny, such as most Islamic countries or the Asian, African and Latin American dictatorships, that does everything in its power to exploit its creative citizens, the only ethical response is to treat their government, not the people, as pariahs. These governments should be granted neither diplomatic recognition nor any type of trading privileges in the more creative countries. At the same time we should declare our solidarity with their people and do everything in our power to communicate the truth which their governments suppress. This can be done through massive broadcasting, clandestine publishing, smuggling of antigovernment literature, granting of refugee status to any ethical person who can escape, aiding ethical revolutionaries, and in every other way directly communicating with the people independently of their government. Probably the single most important information that Soviet citizens could receive to liberate themselves from their oppressive

government would be the plans to a simple copying machine which could be made from readily available materials.

It is unethical to judge individuals, because individuals are far too complex. It is ethical to judge organizations, because human organizations are much simpler than the individuals who compose them. An organization is defined by its goals and rules of behavior *de facto* and *de jure*. An individual is defined by his intelligence, his ethics, and his quantum connection to God. We judge an organization in order to know how to interact with it. Any organization which in any way systematically suppresses and/or exploits the creativity of any person is unethical. This type of organizational behavior is usually obvious, except through gross self-deception. It applies to both our government and that of the Soviet Union. We should always be prepared to communicate ethically with any person, however destructive, but we should totally shun destructive organizations. There is no possible interaction with destructive organizations, other than their annihilation, that can make them less destructive. The annihilation of an organization does not necessarily require the annihilation of the individuals who make up that organization; it requires only the annihilation of the organization's power over all individuals.

In the history of the human race there has never been a destructive organization that became creative, although there have been marginally creative organizations that became more creative and in the process behaved less destructively. Recall that creative entities may occasionally behave destructively. The progressive religions such as Christianity and Judaism and possibly some democratic nations are examples of these marginally creative, evolving organizations. They still have a long way to go. They all still contain destructive elements and subsets. But once an organization becomes destructive it can only become more destructive. It has irreversible entropy. Communist nations can evolve by annihilating or totally transforming the party.

Therefore, it is in the economic best interest of any nation, including those with the most destructive governments, not to trade except with creative nations. The main motivation for many types of trade between nations is unethical political control. There are nations in which the private sector can overcome their government's destructiveness. This is true in almost all democracies, even those that have socialistic governments such as Sweden's.

Insofar as it is possible to interact with private individuals in these countries we should do so. When it is impossible to trade except through a parasitical government, we should avoid doing so. What is in the best interest of the octets is also what is in the best interest of their governments, no matter how destructive the latter may be. The octets will flourish in a free-trade environment. They can only be damaged by trade policies their government imposes on them through other governments. If a nation wishes to maximize its wealth it should pursue the same trade policies as the octets. It

should have nothing to do with tyrannical governments, but should tolerate democratic governments and allow free trade whenever possible between free individuals or between private, nongovernment-controlled organizations. The consequence of this policy would be that either there would be completely free trade between countries, or there would be no trade at all.

Completely free trade between two countries means that there are absolutely no impediments to the exchange of goods, services, information, and persons between and within the two countries. Persons can move as freely between the two countries as they do within their own. Each other's currencies are legal tender in both countries. Workers and entrepreneurs have a free choice of working in either country in a spirit of *laissez-faire* capitalism.

Democratic countries such as Japan that do not allow free trade between their domestic businesses and foreign businesses, but intervene in the market process, would be boycotted until it was just as easy for nonJapanese companies to set up operations in Japan as it is now for Japan to set up businesses in other countries. There would also have to be free two-way migration of persons. Countries that trade in a free manner with some countries but then turn around and trade with tyrannical governments should also be boycotted until they ceased trading with tyrannical countries. It is unethical and self-destructive to support tyrannies either directly or indirectly. This is just as true for tyrannies as for democracies, as Stalin found out after his treaties with Hitler. What makes democratic governments tolerable even when they are totally socialistic is that they fulfill these four criteria:

THE FOUR CRITERIA OF GOVERNMENTAL TOLERANCE

1. They allow the free exchange of ideas and give their citizens complete freedom to criticize their government and to give any kind of true negative feedback; this is less than is guaranteed by the Unites States Bill of Rights, but more than is possible, currently, under *Glasnost*.

2. They allow any ethical citizen the right to emigrate on demand. This is essentially true in the United States and most advanced democracies.

3. They allow two-way free trade—and only two-way free trade—with all tolerable democratic countries that do not support tyrannies. All nations currently violate this criterion by trading with tyrannies directly or indirectly, and limiting free trade with other nations.

4. They in no way support any form of tyranny. All nations currently violate this criterion by trading with tyrannies and, in the case of the United States, even arming them if they are anti-Soviet (as of 1990.)

Any democratic government which follows these policies will maximize the wealth of its citizens and transform itself into a libertarian society and an Ethical State. That is why no democratic government currently follows all four criteria, because doing so would weaken the power of the government over its ethical citizens. All governments support tyrannical governments for what they foolishly regard as political or economic expediency. They all restrict trade in many destructive ways, both internally and externally, although they may to some degree comply with the other criteria. The United States offers more economic and personal freedom than any other country, but this freedom is constantly being eroded to favor whatever special interest groups are most politically powerful at the time.

It is commonplace among almost all modern economists to believe that free trade can only benefit a nation. However, that is only true when it is reciprocal. Even libertarian economists, such as Milton Friedman, claim that if another nation restricts trade and hurts itself there is no reason why we should restrict trade with that nation and hurt ourselves [268]. However, this is a fallacious argument.

The general theorem is that in any free exchange of wealth the least creative party (which usually means the least ethical party, since organizations at the national level are usually of comparable intelligence) receives the greatest benefit in terms of increased wealth. A nation whose government meets the four criteria of tolerance would maximize its wealth and its creativity, while helping do the same for other nations, if it refused to trade any goods or services through any government which did not also live up to the four criteria of tolerance. It would have to do its best to be self-sufficient and live without any alleged trade advantages it might gain from supporting intolerably destructive governments. This would produce hardships at first, but it would quickly lead to a maximally creative and wealthy nation. Its example would eventually cause other democratic nations to follow suit.

The reason why one-way free trade hurts more than it helps is that when there is a government-caused distortion in the free market in the trade between nations, then the exchange is incomplete and more wealth flows from one nation than from the other. It always flows in the direction of the least creative nation. I will give two examples.

The Japanese, as a highly disciplined, well-organized, and highly intelligent people with a collective group ethic, are superior to almost any other people in the mass production of goods and services. However, because of their highly ritualistic society, which forces all persons to become extremely specialized, they are much less significantly inventive and original than the European democracies (or the latter's cultural outliers such as Canada, Australia, and the United States) in discovering important scientific laws, inventing breakthrough technologies, innovating creative social changes, or even in artistic creations, although the Japanese will

quickly accept, and even improve, these innovations once they are created by others. For example, the world-famous Japanese system of quality control was developed by an American, William Demming. It also resulted in quality-control circles of eight persons with both men and women. In the one-way free trade practiced by Japan, the Japanese flood the Western democracies with cheaper and better mass produced goods, *and they take away more wealth than they give.* This imbalance in trade is only trivially reflected in the imbalance of money flowing between Japan and other countries. Recall that money is the least important form of wealth. The true costs are in the creativity of the exploited nations. Recall that creativity is the greatest form of wealth. Once the Japanese learn to manufacture something as well as another nation does, they destroy, by selling at a loss if necessary, the domestic capability in that industry unless the exploited nation takes protectionist measures. For example, in the United States certain key skills in optics, machining, and even electronics are being lost and not replaced because of Japanese dominance of certain markets such as lasers, cameras, motorcycles, copying equipment, memory chips, printers, and consumer electronics. If there were complete, one-way free trade between the United States and Japan, eventually no American automobile, steel, consumer electronics, or textile industry would be left.

By mutual agreement the Japanese and American governments have put quotas on Japanese imports to preserve these monopolistic and quite corrupt American industries. It has been the United States governmental interference in the free market—through defense contracts, government-protected union monopolies, labor laws, regulation of interstate trade, SEC laws, and general favored treatment for the large, monopolistic corporations and unions—that led to a system so corrupt that it could not respond to the Japanese challenge except through protectionism. If this merely led to the collapse of corrupt United States corporate monopolies and their substitution by less corrupt Japanese monopolies, it would not be so bad. But it leads also to the collapse of critical technical skills which may be lost forever to Japan. This in turn makes the United States a more specialized and less creative society, while Japan as it acquires those skills becomes more generalized and more creative. I predict that there will be a constant increase in Japanese technical innovation and a constant decrease in United States technical innovation as long as these trade policies persist. The trends in the patents granted to Japanese and American citizens provide evidence for this theorem.

The United States led the world in patents granted for over fifty years. Today, Japan leads. The United States still out-innovates Japan only in major technological and scientific breakthroughs. As destructive trade between Japan and the United States continues, even this lead will also be lost. The United States will eventually become a totally uncreative society living off its natural resources, as has almost happened to the Soviet Union.

If there were a true two-way trade between Japan and the United States, one of the natural consequences would be that many American companies would set up manufacturing subsidiaries in Japan instead of buying their goods from Japanese companies and in effect becoming Japanese distributors. Another natural occurrence would be a flow of Japanese workers with their collectivist ethic into the United States in order that they might get away from the enormous social pressures of Japan and acquire a higher standard of living. In short, the United States might lose some of its more corrupt monopolistic industries, but through immigration, negative feedback, and example, it would gain an understanding of Japanese organization and collective ethics. The two-way trade would in time lead to the reestablishment of lost industries in the two countries and an equalization of the creativity in the two countries at new higher levels plus an equalization of the standard of living at a higher standard than it was in either country at the start. This is not happening because the trade is not free both ways but is dependent on many unethical agreements between the two governments, all being done on both sides for political convenience with no concern for the creativity of their citizens. Although the standard of living in Japan is increasing, the standard of living in the United States has been decreasing in a significant way since 1965. This is partially reflected in the fact that prior to 1965 almost any person with a steady income could buy a home, while now it takes a middle-class income of a working couple to buy a home. Between 1973 and 1986 true income per person decreased by over 14%! During the same period, household income went down by over 6% in spite of an increase in the number of working couples. The United States has gone from being the world's greatest creditor nation to being the world's greatest debtor nation. This problem is constantly getting worse. The United States would have an even lower standard of living if its government were not increasingly mortgaging its children's future, through deficit spending, in order to avoid economic collapse and deceive the electorate with illusions of economic prosperity.

Another example of trade involving two unethical governments which is not free and is detrimental to both countries is that between India and the United States. In India the government intervenes so much in the economic life that, in spite of its extremely low labor costs and the high intelligence of its people, much Indian industry cannot compete with American industry. However, both India and the United States are democracies who give their peoples freedom of speech and the right to emigrate. Here is where the imbalance of trade occurs.

The Indian government tightly controls all large industries in its country. It wishes to diversify its economy in order to become self-sufficient. The best thing it could do would be to allow free trade and allow creative entrepreneurs from all over the world and within India itself to operate untrammeled by government control. Instead, it makes monopolistic agree-

ments with monopolistic corporations from other countries, including the United States, to set up critical industries in India. These industries—produced by the interactions of two destructive organizations, the Government of India and the foreign Corporate Monopoly—are even more corrupt and inefficient than the original foreign monopoly (this is the opposite of what happens in Japan). In the process the foreign monopolies (including unions) become wealthier and more destructive in their home countries, and the creative potential of India is actually lowered. The Indian government, through regulation of creative entrepreneurial organizations, thereby denies these organizations and its people opportunities to be creative and to increase their, as well as India's, wealth. Countries such as the United States pay for this imbalance in trade by the strengthening of their most destructive monopolistic corporations and by limiting the economic opportunity of their most creative non-monopolistic organizations. The government of India pays for it by losing its most creative citizens and entrepreneurs as emigrants to the more libertarian society of the United States, and by the constant loss of its own capacity to innovate creatively in any field of the economy. Only the constant importation of foreign technology as well as foreign credits and aid keeps the Indian economy and those of similarly corrupt socialistic democracies (e.g., Mexico, Peru, and to a lesser extent, Israel) from collapsing. Other less corrupt socialistic democracies such as Sweden and New Zealand have learned not to kill the goose that lays the golden eggs by not directly controlling the economic sector, but by merely controlling the distribution of most of the golden eggs to the bureaucracies which support the government. Unfortunately, this usually means almost complete government control over all forms of education. Creative self-sufficiency must begin with an alternative to bureaucratically controlled education. All forms of democratic socialism are unethical.

Therefore, what is best for the octets is also best for the nations which host them. The ones who would oppose the octets and more libertarian policies are the political, governmental, union, and corporate monopolies or oligopolies who derive their power from the destructive control of creative persons and the redistribution of their wealth. These entities hold the balance of power in all democracies; they are not likely to implement the four criteria of toleration in their societies even though these maximize the wealth and power of their nations. But there is hope.

The hope in the democracies is that the most destructive organizations, e.g., the Republican and Democratic parties in the U.S., will be more concerned about destroying or controlling each other than they will be about destroying or controlling the apparently insignificant octets. Once the octets grow in number, their own example, wealth, and socially responsible openness to new membership may convince a majority of the electorate to join the octets and vote for a libertarian society. Ronald Reagan, who greatly increased the size of government, used libertarian rhetoric to im-

pose a plutocratic oligopoly (particularly the western branch of organized crime) on the United States, while greatly diminishing liberty by expanding the power of the CIA, FBI, IRS, INS, and other police organizations [863-876]. The octets hope to use example to create a true libertarian society and an Ethical State.

The four criteria for a tolerable democracy are intuitively appealing to almost all ethical persons. If a majority of the electorate is still ethical, then the Ethical State and the octets that constitute it cannot be stopped from growing in any democratic society. The octets may even grow in communist societies through the moral courage of persons such as Gorbachev. This can lead to an infinitely expanding Moral Society.

CHAPTER 8

A Vision of the Future

We are going whence we came. We are evolving toward the Moral Society, Teilhard's Point Omega, Spinoza's Intellectual Love of God, the Judaeo-Christian concept of union with God. Each of us is a holographic reflection of the creativity of God. The Moral Society is an amplification of the hologram. Each of us is to the Moral Society as one of our cells is to us. The Moral Society is not God but it is a quantum leap which brings us closer to God. God is the infinite process that underlies all creativity and all evolution. The pattern of evolution is that the raw energy of the cosmic singularity evolved into elementary particles; elementary particles evolved into hydrogen; hydrogen evolved into all of the other atoms. The only fully autopoietic atom, carbon, evolved into organic molecules; organic molecules evolved into systems of self-reproducing molecules; systems of self-reproducing molecules evolved into autopoietic cells which then evolved into higher-order autopoietic systems of their own—the metazoa. The metazoa in turn evolved ever more complex nervous systems within themselves, resulting in the formation of the four complementary paired brains of humanity. And finally humanity has evolved to the point at which it has become "evolution conscious of itself" (to paraphrase Julian Huxley), ready to consciously and deliberately engage in autopoiesis and creatively transform itself into the Ethical State and the Moral Society.

The Ethical State

The Ethical State is a transitory state between what we are and what we can foresee becoming. As a transitory state it has no clear beginning or end. We only know when we have already passed it. The Ethical State begins with ourselves, but it only ends with more than ourselves. It ends when a critical mass of humanity has become moral and its constituent members have learned to love each other unconditionally.

What is "critical mass"? A critical mass is clearly not less than an octet. It may need to be more than an octet of octets, or, indeed, more than

8^8 octets (16,777,216 octets). There is at this time no exact theory that will predict what will be the critical mass of moral persons who will make up the Moral Society. What we do know is that it is not possible to ethically love too much or to ethically love too many.

Therefore, we begin the Ethical State with ourselves by doing our best to follow the evolutionary ethic. This involves doing the best we can to maximize creativity for ourselves and for others. This by itself will begin the creative transformation process in an irreversible chain reaction, if we make a full commitment to play the Game of Life. But we must take all the eight steps to become creatively transformed beyond the Ethical State into the Moral Society (see pages 268–70, 276). At first each step is more difficult than the previous one. But eventually the steps begin to become easier. Furthermore, the act of taking each step tells us what the next step should be. It accelerates the process to know in advance what the eight steps are, even if we take only one step at a time.

It is relatively easy to make a choice to play the Game of Life, although so many of our species reject the Game out of ignorance and fear. It is always easier to do what we can do alone. But the second step involves learning to love each other. We cannot love alone.

It is easy to become smug in our self-righteous commitment to the evolutionary ethic and to justify to ourselves everything we do as subjectively doing our best to maximize creativity. But in the words of St. Paul to the Corinthians: *"Though I speak with the tongues of men and of angels and have not love, I am become as sounding brass, or a tinkling cymbal. And though I have the gift of prophesy and understand all mysteries and all knowledge; and though I have all faith, so that I could remove mountains and have not love, I am nothing. And though I bestow all my goods to feed the poor, and though I give my body to be burned and have not love, it profiteth me nothing."*

However righteous and ethical we are in our own life, if we do not love others we will fail to be creatively transformed. We cannot maximize creativity alone. Even God had to create us to maximize His creativity. Furthermore, it is insufficient to merely go through the motions of love. We must feel and give love from our souls or we will fail to be ethically transformed. I quote St. Paul because he failed, even though he knew what must be done. St. Paul, more than any other person, changed the teachings of Jesus into a religion of fear.

The only proof of the sincerity of our love for others is that we help reduce their fear and help them be more creative. Whenever we cannot help reduce the fear of others it is because (1) we have not yet learned to love sufficiently to be creatively transformed, or (2) the other person is unethical with irreversible entropy. Remember that even Jesus was not able to love enough to keep his enemies from killing him. When we fail in our love for others, we will do best to be humble and assume that the failing is in

ourselves and not in the person we sought to love. Otherwise we will tend to become smug and self-righteous and will fail to be creatively transformed. It is always best for ourselves not to judge others, and along with Jesus to forgive those who know not what they do. For if others know not what they do and we do know, then we have failed to teach through love. Creative transformation cannot be learned, taught, or achieved without love. Those of you who set on the path of creative transformation will find that the second step is much harder than the first but not nearly so hard as the third.

The third step is the conquest of fear. The only antidote to fear is love. We must have achieved a considerable increase in ethics and learned to love others before we conquer fear. Recall that fear is the belief that we cannot create. Every negative emotion is a manifestation of fear. If we ever have the slightest twinge of anger, greed, jealousy, hatred, or any other negative emotion, we are still being driven by fear. Furthermore, the last fears we overcome are unconscious—we do not even know we have them. Subjectively, we know we have conquered fear when we love *all* of our enemies from our soul and do not feel the slightest twinge of animosity towards them. The only objective evidence we will ever have that we have conquered fear is threefold: (1) we are never destructive to ourselves or others; (2) *no one* responds to us with fear; and (3) all whom we love from our soul return our love from their soul by reducing destructiveness and expressing objective creativity. Before we achieve this state we must learn to love those who hate us and reject our love. Autopoiesis is our ally in this process.

It takes only a moderate level of ethics, love, and courage to begin autopoiesis, which is the fourth step. All who can begin the process and stick with it—modifying it and changing it, particularly in choice of partners, to fit their needs—will in time become creatively transformed. The essential feature of the octet is that it serve simultaneously both as a source of negative feedback and as an object for love. In this way we creatively transform ourselves by helping to creatively transform seven other persons. Autopoiesis is a quantum process which catalyzes the previous three steps and itself and facilitates our taking the fifth step, which is to become self-sufficient within an octet or network of octets.

Starting with autopoiesis each of the subsequent steps becomes easier and easier until creative transformation becomes an irreversible process. Autopoiesis is the critical step. We must have increased our ethics and capacity to love and we must have lowered our fear enough to take this step and then let the process work on us. If we can do this then, the process will become irreversible—if we have the ability and the courage to create octets around us.

We can be helped in the beginning by being incorporated into an existing octet that someone else has created. But eventually we must each serve alone as a seed which can recreate an octet that meets our personal,

ethical, intellectual, and emotional needs. Only then will we be assured that creative transformation has become an irreversible process for ourselves. We will have then entered into an Ethical State.

This book has aimed to help each person achieve the Ethical State in his/her own way without having to depend on anyone. I hope you have learned from my mistakes and that you do not feel compelled to repeat them. I recommend that those who can begin alone, try it! You need no guru. Those who have difficulty creating an octet for themselves have, through SEE, at least one octet available to them who will help them begin autopoiesis and creative transformation. This service is available free without any obligation on the part of those it serves other than to sign and do their best to live up to the Contract for Creative Transformation. They can walk away from the contract at any time with no penalty (p. 256).

I have presented one technique for engaging in autopoiesis. There may be many more. We are currently developing a radical new technique that uses electromagnetic brain wave resonance in lieu of touching. We have tried many variations on the current technique. Nothing seems to work as well as the process that was described in Chapter 5 (and further elaborated in the Appendix). I wish I knew a less frightening technique. Hopefully the new, more complex technique will be more effective, but it will require special equipment and be more difficult to start. However, you may have newer and better insights about how to begin creative transformation and autopoiesis. You should follow your intuition and do what seems right for you. If you and the others associated with you increase in ethics, creativity, and love, the process will catalyze and optimize itself however you choose to begin. But you must try. The Ethical State will come about only through the choice to create it. The Ethical State, like all biological evolutionary quantum leaps, must be chosen. It does not come about by chance or necessity.

Once persons begin moving toward the Ethical State consciously and deliberately, they will catalyze one another and in an exponential process they will bring about an ethical, libertarian society. The process should go as follows:

1. At least one person makes a commitment to the evolutionary ethic and deliberately begins playing the Game of Life.
2. At least eight persons create an octet of four men and four women committed to creative transformation for one another.
3. Each octet helps create other creative transformation octets.
4. Individually and collectively the octets begin to become economically self-sufficient.
5. At least one octet creates a school, similar to the SEE concept, dedicated to maximizing the creativity of its students.

6. The octets supporting the school have a rapid and massive increase in wealth, not through the pursuit of wealth but through the pursuit of maximum creativity.
7. The wealthiest octets are the most creative octets; they expand their networks to create more octets of all kinds and more schools.
8. Each network of octets serves as a positive example to all nations for transforming their governments and societies into libertarian, ethical states.
9. Once any society has an ethical libertarian economic system and creative persons are no longer coerced into supporting destructive bureaucracies, then the wealth of the society will concentrate rapidly into the hands of its most creative members and the networks of octets will grow even faster than before, thereby providing greater creative opportunity and security to all members of the society.
10. The most creative networks of octets will begin transforming themselves into a Moral Society; through the universal social responsibility of the Ethical State they will help transform all persons who wish to join them.

An Ethical Network

Once the Ethical State has been achieved by a critical mass of persons, they will organize themselves into autonomous networks which will eventually replace the nation-state. An ethical network is a voluntary association by two or more octets which accept a common set of values, operational procedures, and goals, and which agree to work together to create a Moral Society while engaging in composite autopoiesis between all member octets of the network. These goals and procedures may be as general as those given in the Epilogue, or they may be more specific. The more specific the goals and operational procedures, the smaller and more exclusive the network. Thus, it is possible to have networks within networks within networks. The common denominator for all members of an ethical network is that they:

1. Openly accept the evolutionary ethic;
2. Make a total commitment to the Game of Life;
3. Sign a common contract for creative transformation;
4. Are incorporated into an octet;
5. Belong to a network of at least two octets;
6. Accept as morally binding only laws derived from the evolutionary ethic, e.g., the Eight Ethical Principles and the Game of Life;
7. Seek autonomy from all other forms of government; and,
8. Do their best to be self-sufficient.

An Ethical State evolving toward a Moral Society would give each such network the rights of a sovereign state. The network itself would give the same rights to each member octet. Each octet would have its own sovereign territory with mutual defense, access, and territorial transfer treaties with other octets. Each octet would in turn give similar rights to its members and their dependents. All individuals would have sovereign rights over their bodies, so long as they were not destructive to others.

Such a society would have no laws which were not unanimously accepted by all octets. Persons not in octets would be subject to the laws of whatever octet they interacted with. The only practical and ethical legal recourse against any lawbreaker would be to exile him/her from the territory of the octets whose laws he/she broke. Exile would consist in denial of access to octet members' territory and denial of any trade with any member of the octets in question.

Resolution of disputes and prosecution of criminals would be done by neutral octets within a network. A neutral octet would be any octet within the network to which neither the plaintiff nor the defendant belonged or had personal ties. The resolution of a complaint would be binding in noncriminal cases when it was agreed to unanimously by one neutral octet. Since in criminal cases exile might result, a binding decision might involve unanimity of two neutral octets instead of only one.

Any set of four women and four men could declare themselves an octet and join any network that would have them. Persons could belong to several octets. Octets could belong to several networks. Territorial and trade disputes between networks could be resolved by neutral octets from the supernetwork to which both subnetworks belonged. If no such supernetwork existed, then the two networks would have to work it out between themselves; there would be no higher authority they could appeal to. They could choose an arbitrator by mutual consent, impose sanctions on one another, or even go to war, so long as they did not violate the laws of other networks or their own laws. As ethical organizations they should find a creative solution to their differences. Insofar as networks with nonadjoining territories had disputes, they would find it difficult to wage war with each other without having to impose on intermediate networks. Ethical organizations would merely exile implacable foes and not wage war against them except in instances of self-defense. Ethical networks would never see each other as implacable foes. Therefore, there should be no war between ethical networks.

Supernetworks would be created for adjudicating all disputes over territory between ethical networks. The basic law would be that territory could be traded between octets. Within any network, octets would share territory within limits by allowing members of the network limited access to each other's territory, by having rights of crossing, and through commonly accepted land usage and anti-pollution laws. If an octet did not agree to

these restrictions, it could leave the network and join another network or remain an autonomous island within a network.

This type of networking could begin within an existing society such as the United States. Some networks would agree to settle all issues among themselves and to avoid the central government whenever possible. These networks would trade privately among themselves, educate themselves, and provide for their common welfare, defense, and health, asking nothing from the central government. As these networks grew, they could become totally autonomous of the central government through their technological and creative superiority; further, they could cooperate with other autonomous networks for defense against infringements on their autonomy by any government not their own.

In this way, over a period of time, an ethical supernetwork of ethical networks can evolve within the United States and other relatively free nations that will provide new creative opportunities in economics, education, health care, self-sufficiency, artistic expression, and personal security. If it is truly creative, it will eventually include a critical mass of ethical members which will lead to the creative transformation of the earth into a world of autonomous ethical networks, all trying to maximize creativity according to the dictates of their conscience.

The ethical networks will liberate the creativity of all human beings who wish it and give them the opportunity to develop their maximum creative potential within an atmosphere of ethics, love, freedom, and security. There may be hundreds of millions of octets and millions of networks, each one an independent experiment in how to maximize creativity and bring about a Moral Society. All ethical persons may alone begin an ethical network and structure it according to the dictates of their own conscience. The ethical network, as a subset of the Ethical State, is the first supermetazoan entity that has the potential to evolve into a Moral Society.

Foundations of the Moral Society

By extrapolation of the evolutionary process, it is conceptually easy to imagine a supermetazoan organism which would result from the autopoietic interaction of many thousands or millions of men and women. Their interactions may begin in octets and networks of octets or they may begin in another way. There may be an infinity of ways of achieving an Ethical State. The net result (in terms of our earlier description of the components of Intelligence, pp. 14–17) would be that there would be a common Information (F) base that everyone could tap and a rapid, almost instantaneous (real-time) communication of ideas among all members of the Moral Society. This is what is starting in the computerized communications networks and composite autopoietic networks of the octets. The first is a classical technology. The second is a quantum technology. As both technologies

improve, it will become easier and easier for persons to have quick access to an ever larger common database and to quickly exchange ideas at the quantum level between persons in ever larger networks. The classical technology will create a supermetazoan Memory (M) and Connectors (N) (nervous system). The quantum technology will create a supermetazoan Imagination (G) and Will (W).

Autopoiesis, in all its forms, is a technology for amplifying Imagination (G). *It works only for persons who are ethical and who are becoming more ethical.* This is typical of quantum technologies. They cannot be used destructively. Classical technologies such as the computerized communications networks can always be used destructively, since their use depends only on intelligence and not on ethics, although they could not have been created without ethics. This is part of the cosmic quarantine.

In 1988, through autopoiesis, we developed a design for a device we call a "Quantum Ark." It is a hybrid classical-quantum technology that cannot be fully utilized except through an autopoietic octet. It is a machine which, among other things, can move in three dimensions without having any moving parts. It can convert gravitational energy into electromagnetic energy and vice versa. The design is currently being used in developing an experimental prototype. It is a practical result of integrating information theory, quantum mechanics, and relativity within an autopoietic context. It may be an excellent objective test of the autopoietic process while, as a major side effect, it may serve as an aid to autopoiesis. This is how evolution catalyzes itself and leads us to the Moral Society.

The Moral Society reflects the holographic nature of the universe [62, 63, 838]. Each member of the Moral Society has reflected within him/herself all the Information (F) of the entire Moral Society. This implies that the entire Moral Society can be recreated from any one of its members, just as the goal in each octet or network of octets is to have each member be a seed which can recreate the entire network from itself. Similarly, each cell in our body contains all of the information of our entire body.

A hologram gains coherence and purity as it completes itself, even though each part of the hologram contains the whole. Similarly, the collective creativity of the Moral Society becomes greater as it incorporates ever more autopoietic members. And similarly, God becomes ever more creative as the process of God incorporates ever more Moral Societies. This is how the universe catalyzes itself and grows forever in creativity.

Historically, human organizations in general have diminished individual human creativity. Creativity has been an individual process which is inhibited by being forced to conform to the strictures of a classical organization. Until the creation of the octets, the creativity of an organization has never been greater than that of the solitary individual creativity of its most creative members. That is because the octets are the first quantum organization. The octets, through autopoiesis and complete personal freedom,

make each member collectively more creative than the member would be alone. The octets amplify both Ethics (E) and Imagination (G). This will occur on a much greater scale when the octets learn how to exchange Information (F) and interact optimally so as to maximize creativity in a network no matter how large.

The Moral Society will begin when it is possible to add moral members to it without limit and have each new member always amplify the creativity of all members including itself. The key word is *moral*. A Moral Society can only be created with moral persons. Recall that moral persons are those who never destroy because they always value truth absolutely over happiness; their Imagination (G) always generates unlimited true Information (F); they are never driven by fear. To the best of my knowledge no human being has ever been totally ethical, i.e., moral, not even the great moral leaders such as Buddha, Confucius, Socrates, Jesus, Spinoza, and Mahatma Gandhi. It is easy to find ethical mistakes in even the mythical, idealized accounts of the lives of all these highly ethical leaders. Therefore, morality, at this time, exists as a field of study (how to optimize ethical behavior) and as an idealized concept ($E = 1$)—a totally ethical person. We can imagine the end result, but so far we have not been able to practically achieve it. The great ethical teachers merely approach morality. They never quite reach it. The Ethical State is a process for getting there.

What has been lacking up until now are organizations that combine objective science, mystical insight, and the sole goal of maximizing creativity, i.e., those with a fusion of classical and quantum organizational technologies. Each octet helps each person liberate the mystical insight which is the foundation of all creative imagination. However, for persons who are not yet moral it is also the foundation for destructive self-deception. When we are driven by fear, our ego will warp Information (F) generated by the Imagination (G) into false Information (F), which deceives us and decreases our creativity. Fear also makes us more prone to accept comforting falsehoods than to believe unpleasant truths.

The main purpose of science is to enable us to separate truth from self-deception. Only persons and organizations dedicated to the evolutionary ethic will joyfully subject every belief they have to scientific scrutiny. Those who value truth will always delight in discovering a cherished belief to be wrong. These types of discoveries lead to quantum leaps in creativity through a dialectic process of thesis, antithesis, and synthesis. It is possible that we will learn more if our design of the Quantum Ark fails than if it succeeds. There is never any actual failure possible for those who live by the evolutionary ethic. Their creativity is always being maximized. All who play the Game of Life win.

The octets, therefore, serve as support groups for persons dedicated to the evolutionary ethic who use mystical insight to expand the frontiers of knowledge and then subject their insights and all their syntheses to objec-

tive, scientific scrutiny. This is the core of their genetic code. Autopoiesis, as described in Chapter 5 and the Appendix, is merely one of many possible quantum amplifiers of creative imagination. The Quantum Ark is possibly another that has not yet been tested.

The Moral Society would contain this same genetic code. It would have a much more advanced form of autopoiesis in which the classical and the quantum technologies would be fused to achieve levels of Information (F) transfer in both the quantum and the classical modes that we can only begin to imagine. In this way the supermetazoan, collective creativity of the Moral Society will grow without limit. Each component of intelligence will acquire infinite potential.

Our biological intelligence is limited by the 10^{-13} gram of DNA that is the maximum amount that can be contained in the largest cell. I suspect that we are at that limit now or soon will be. The genetic code of the Moral Society is not biologically limited, since all the components of its collective intelligence are extragenetic amplifiers of its original DNA.

The Moral Society is the hologram which we are in the process of completing. The central element of this hologram which is reflected throughout the universe is the Will (W) to maximize generalized intelligence by autopoietic interaction among four complementary pairs. This is the central criterion in the evolution of matter, life, and mind. At each point of quadrature, through a new quantum leap in autopoiesis, we add a new dimension to the previously highest generalized intelligence: chaotic energy, quantum gravitons, quarks, electrons, nucleons, hydrogen atoms, helium atoms, carbon atoms, all other atoms, RNA, protein, DNA, cells, metazoa, nerve nets, single brains (fish), dual brains (reptiles), triple brains (mammals), quadruple paired brains (humans), octets, networks of octets, an Ethical State, a Moral Society, a network of Moral Societies, a Cosmic Moral Society (Local Moral Society), converging to God at infinity. The process has no end. It grows in creativity forever.

Our potential creativity is going to infinity as our ethics goes to unity. When we are moral and $E = 1$, then the Imagination (G) is completely derandomized and we have infinitely true information at our disposal. Our creative potential is literally infinite. This is Pierre Teilhard de Chardin's Point Omega, where we are one with God, and our evolution—in the infinite universe of all universes—begins. The challenge then becomes to create a better universe than the universe that created us. That is how LMS may have created us. That is how we and LMS together may create an infinite hierarchy of ever-improving universes.

This potential is within our reach. Only our own fear can destroy the one opportunity that we have. We need merely choose to take the opportunity in order to succeed.

Millions of years ago our ancestors had multiple problems to overcome. They had to choose to innovate tools, walk upright, and lose the

security of walking on all fours. This led to the irreversible mutations that produced the hominids. This turned us into an ethical species. Today we have a dual choice to (1) begin creative transformation and (2) become a moral species. We cannot each do it alone. We have to do it as a species. What we lose this time is our fear and the delusions produced by fear. It is our attraction to our own fear that keeps us from unity with the Cosmic Moral Society (Local Moral Society) and the creation of new universes.

Each universe created is one in an infinite series of experiments leading the universe of all universes to God from God. The ancient mystical symbol and archetype of this quantum process is the serpent swallowing its tail. Therefore each quantum leap in the evolutionary hierarchy reflects both its past and its future. Each time a new dimension is added to the evolutionary nucleus all the previous dimensions are kept, and the evolutionary nucleus becomes an ever greater and more coherent part in the infinite hologram which is God. Each evolutionary hologram is a part of a greater evolutionary hologram. Nothing is ever lost in the Game of Life. All who play always win.

Structure of the Moral Society

Since the Moral Society reflects both its past and its future, we know that it will be a new dimensional quadrature of the eight components of intelligence. The last dimensional quadrature occurred when our intelligence folded upon itself and we could predict and control our own ability to predict and control. This was the beginning of ethics. There is evidence that this ability is not unique to humanity but also exists in a much reduced state in some of the other higher primates, the cetaceans, and perhaps even the elephants, who may also have some creative linguistic and tool-making capabilities. That is why humans have an ethical obligation to protect these possibly ethical species and not exploit them.

The next dimensional quadrature to our intelligence is to become moral and be able to predict and control our own ethics. This means that $E = 1$ for all mature members of the species. There are almost certainly higher orders of dimensional quadrature than becoming moral, but it is not clear what they mean. To be able to predict and control morality may mean to be able to create a new infinite hierarchy of universes with a new moral structure, just as LMS created this universe. That is likely to be the destiny of our Moral Society when it rejoins LMS and becomes its complementary pair.

Once the Moral Society starts, it accelerates its own evolution by creating ever greater extragenetic amplifiers of its own intelligence. That is what we have been doing for millions of years, first with simple tools to amplify our Effectors (R), then language to amplify our Connectors (N) and Memory (M), then writing to further amplify our collective Connec-

tors (N) and Memory (M), then ethically-based religions to amplify our Will (W) in general and the ethical component of our Will (W) in particular, then the balance, microscope, and telescope to amplify our Sensors (S). Earlier we amplified our Sensors (S) with biological machines such as the domesticated dog (smell) and the domesticated bird-of-prey (vision). With formal systems of Logic (L) such as mathematics, Aristotelian syllogisms, and the abacus we amplified our Logic (L). This process has been greatly enhanced with computer networks that further amplify Logic (L), Memory (M), Connectors (N), and Effectors (R). Our machines are of three classes: (1) those that amplify Effectors (R) (the vast majority); (2) those that process Information (F); and (3) those that do both. Within those classes of machines we amplify Effectors (R), Sensors (S), Memory (M), Connectors (N), Information (F), and Logic (L). Ethical religions amplified ethics and Will (W), but at the cost of destroying Imagination (G) through certainty, repetitive ritual, and above all through fear. Modern religions have usually moved away from fear; Islam, Christian Fundamentalism, and Leninist communism are exceptions. Many sects of Christianity, such as the Baptists, still emphasize reward and punishment, although others, such as the Unitarians, have almost totally eliminated fear from their practice. As modern religions move away from fear, ritual, and certainty, while emphasizing ethics, they amplify the ethical Will (W) of their members while doing less damage to their Imagination (G). This even applies to purely classical religions such as Communism, which in its Polish and Hungarian versions is apparently becoming less destructive. Under Gorbachev, Soviet Communism appears to be trying to move away from fear as a means of controlling its citizens. But all forms of communism still have a long way to go before they are ethical, libertarian societies. However, they are clearly trying. This is a significant development which should be encouraged, since it implies that some forms of communism, perhaps even the Soviet model, may not be closed.

Most religions, unlike all the other amplifiers of intelligence discussed, are partially quantum devices, at least in their origins and in their fundamental structure. They become classical when they deny the quantum connection—e.g., communism, Neo-Darwinism, and Satanism—and they become dogmatic, ritualistic, and fear-ridden, with a repetitive fixed formula for going to heaven—e.g., orthodox Leninist communists and Islamic or Christian fundamentalists. Heaven for communists is a Marxist utopia. Humanity has never invented a machine for amplifying Imagination (G) until now.

The creative transformation process is a quantum machine with some classical components which amplifies ethical Will (W) as well as Imagination (G). The latter is done by autopoiesis; the former is done by the first four steps collectively. Although creative transformation is still at the crude prototype stage, it is self-catalyzing and sufficiently developed to form the

basis upon which the Moral Society can perfect the process. The general structure of the Moral Society follows by rational extrapolation.

The Moral Society will be a quantum being with classical components. As the Moral Society evolves it will rely less and less on its classical components until it transcends matter, space, and time, becoming one with the Cosmic Moral Society. At first the Moral Society will consist of human beings, classically united with each other through highly advanced computerized communications networks that enable any person to know what every other person knows and to give and receive quick feedback to and from everyone in the Moral Society. In parallel the individual members of the Moral Society will be quantumly united by mutual love and advanced autopoiesis. Advanced autopoiesis will be to the current forms of composite autopoiesis as the most advanced computers are to the abacus. The Quantum Ark is already a step in this direction. The ethical love of the Moral Society will be the same as ethical love has always been—unconditional giving of ourselves to others with the sole goal of maximizing our collective creativity. This is what parents do when they truly love their children without fear or selfishness. It is what Jesus meant by love when he gave as his sole commandment that we love one another as he had loved us. This gives the structure of the collective Imagination (G), Memory (M), Connectors (N), and Logic (L) of the Moral Society. The collective Will (W) of the Moral Society comes from its collective morality. Since all its members are moral, have access to the same Information (F), and are in constant communication with one another using a common computerized system of Logic (L), they are all driven solely by the evolutionary ethic with no possible conflicts among them—any more than there are possible conflicts among the individual cells that make up our body, so long as they share a common DNA. The explicit evolutionary ethic (the Game of Life) to which all members of the Moral Society are totally committed and their communication network, both quantum and classical, are the DNA of the Moral Society. Within this central code is the Information (F) for the Moral Society to continually recreate itself, as well as for creating an unlimited number of Effectors (R) and Sensors (S).

The classical Sensors (S) of the Moral Society will be the mechanical, electronic, optical, chemical, and biological machines which it will send throughout the universe with its machine Effectors (R) to gather Information (F). Its quantum Sensors (S) produced by its collective Imagination (G) will go beyond the universe to gather even more Information (F). The machine Effectors (R) of the Moral Society together with its machine Sensors (S) will spread throughout the physical (local) universe at a speed just below the speed of light. The Information (F) from these machines will return at the speed of light. Solely through classical means plus the use of our Imagination (G) it is possible to understand the physical, biological, and psychosocial universe which we inhabit. Forces originating outside of

our universe—that is to say, outside of our time and space and not bound by energy or matter—we can understand only partially through classical means and need a maximum input of quantum (non-local) Information (F). All quantum phenomena are a manifestation of hidden variables, as Einstein had foreseen. What he had not foreseen was that the hidden variables were outside of our time and space.

As the Moral Society extends itself throughout the physical universe and continues to amplify its Imagination (G) in ever greater ways, it will transcend the Information (F) limitations of the local physical universe. The quantum universe is an unbounded universe of infinite Information (F) outside our time and space. It is the set of Information (F) making up all universes that have ever been created and ever will be created. It consists of Information (F) from an infinite past and an infinite future. To transcend matter, space, and time is to become one with the infinitely expanding Information (F) of the quantum universe.

As the Moral Society transcends its physical limitations it becomes more a being of pure Information (F) and less a being of matter, space, and time. Its structure becomes ever more a reflection of its mind as its mind evolves asymptotically toward pure thought. Pure thought is Information (F) which does not depend on energy or matter. Pure thought may be the basis of the quantum universe.

There is evidence that a Moral Society may transcend the classical components of its structure very quickly and communicate entirely at the quantum level. The evidence for this is both theoretical and experimental.

Theoretically, quantum communication would be optimal because it is instantaneous and in no way limited by time and space. The problem is that it is unreliable at the personal level. However, at the level of the Moral Society there will be a quantum coherence produced by the interactions of the quantum connections of many persons. This may make quantum communication as reliable as lasers, superfluidity, or superconductivity—which are highly reliable, macroscopic, quantum phenomena produced by coherence among billions of unreliable submicroscopic quantum phenomena. The Moral Society would be the largest-scale coherent, macroscopic, quantum invention ever produced, and it might communicate anywhere in the universe instantly, entirely through its coherent collective quantum connection.

The evidence that this is how all Moral Societies communicate once they have transcended the cosmic quarantine is that the SETI (Search for Extra-Terrestrial Intelligence) project, as well as thousands of radio astronomers, have never found any electromagnetic signals that seem to be intelligently generated. Since the universe is between 10 and 20 billion years old, there has been plenty of time and opportunity in our own galaxy and in the billions of other galaxies to produce at least millions of civilizations more advanced than ours as well as the resultant Moral Societies. The fact that intelligent communication between star systems by means of electromag-

netic radiation is apparently rare or nonexistent indicates that one or more of the following hypotheses is true:

1. At all stars, evolution leading to a technological civilization is very rare.
2. Almost all civilizations that reach our level of technology quickly destroy themselves.
3. Advanced civilizations use electromagnetic communication for only a short time before passing on to more advanced forms of communication.

Although all three or any combination of the three hypotheses might be true, my intuition is that the third is the main reason why we have not detected any ETI. The reasoning goes as follows: If the second hypothesis is correct, then LMS failed in the design of the universe by not adequately providing a moral structure for ethical species to keep from destroying themselves. All the evidence from the fine-tuning of the universal constants to our own ethical history is that LMS has provided plenty of opportunity for a species to evolve forever without destroying itself. Based on our own probability of survival, at least 10 percent of the technological civilizations should survive and evolve into a Moral Society. Therefore, the second hypothesis is probably false.

Bode's Law, which implies that planets are created at regular intervals from the sun, indicates to me that many stars including multiple star systems will have at least one planet within the ecosphere, the region around the star in which a planet with liquid water can exist and allow life to evolve. Our ecosphere is roughly the shell between the orbits of earth and Mars. This is a logical provision for LMS to have made in order to maximize the creativity of the universe. Therefore, the first hypothesis also is probably false.

Since our star, the sun, is less than one third the age of the universe, since there are over 200 billion stars in our galaxy, and since there are well over 200 billion galaxies similar to our own within one billion light-years from us, there should be billions of civilizations as advanced or more advanced than us within "hailing distance." The fact that we cannot hail them and they do not hail us indicates to me that they do not communicate electromagnetically. This is also part of LMS' cosmic quarantine. It limits the interstellar noise produced by fearful species. Therefore, the third hypothesis is probably true.

Given that electromagnetic communication is a transitory phenomenon in the history of technological civilizations and in the evolution of Moral Societies, then we are left with three alternatives: civilizations more advanced than us (1) communicate with tachyons; (2) they communicate with their quantum connection; or (3) they communicate by an unknown means. There is not much we can say about the third alternative.

Tachyons are hypothesized particles that travel faster than light. We

are not sure that tachyons exist. If they do exist they would be by far the most efficient means of classical communication for any civilization extending its intelligence beyond its planet [326]. However, because tachyonic communication as a classical technology would be available to destructive persons and could be used destructively throughout the universe, this would violate the principles of the cosmic quarantine. Therefore, I do not believe that tachyonic communication is possible. If tachyons exist they should have too low a signal-to-noise ratio to serve as effective particles for communication. My intuition is that tachyons and other superluminal forms of non-quantum communication do not exist, so that it is impossible to get around the cosmic quarantine by classical means. Interstellar autopoiesis is probably a purely quantum process that is possible only for moral species. The universe is singing, but our fear deafens us to its song.

Therefore, the Moral Society probably quickly evolves from the Ethical State into a quantum being that communicates instantaneously through its quantum connection with other Moral Societies throughout the universe and becomes one with them. Part of the cosmic quarantine is that it is not possible to plug into the universal communications network until a species as a whole has become moral and can produce quantum coherence. It seems that only moral beings are totally without fear and can hear the song of the universe. Once a species is moral it cares nothing for its collective ego but is focused entirely in communicating Information (F) that will maximize the collective creativity of the universe. The pattern of evolution is to create ever greater information networks that are able to better communicate the infinite Information (F) of the quantum universe, e.g., the hierarchy of the nervous system. This is how we are evolving and how it seems to me everything must evolve.

There is a hierarchy of ethical obligation in evolution. First to ourselves, then to our families, then to our friends, communities, nation, species, biosphere, star system, galaxy, universe, universe of universes converging at infinity in God. If we fulfill the hierarchical nature of our obligations, then we are best fulfilling our obligation to God—which is to do our best to maximize creativity.

We clearly must begin with ourselves. If we cannot help ourselves we cannot help anyone else. We also have an obligation to offer our help in creative transformation first to those who have helped us through their love, support, and education. Then we offer our alliance in creative transformation to those who can best understand and benefit from our help. That is how the hierarchy of creative interaction is created.

Therefore, the Moral Society will first put its own house in order before expanding throughout the universe through the direct quantum exchange of Information (F). Either the Ethical State or the Moral Society will begin the process of helping other species in the biosphere who have the potential to evolve into Moral Societies by protecting them from human predation and encouraging them to innovate. The higher primates, the

cetaceans, and the elephants are prime candidates in this area. But we should show compassion toward all animals and stop their exploitation. Every living creature has a quantum connection to God. The entire biosphere is interconnected, even those species with irreversible entropy. The latter merit our compassion, not our contempt. At the same time the biosphere will be extended throughout the solar system in space colonies, as foreseen by Gerald O'Neil in his book *High Frontier,* and other writings, by colonizing other planets and/or their satellites. The major opportunity seems to be in filling the ecosphere with self-sufficident satellites. The Moral Society will then fill the entire solar system and it will begin at this point if not before to exchange Information (F) with other Moral Societies in the galaxy that are not too far advanced. This will accelerate the evolution of these primitive Moral Societies through an interstellar autopoiesis until they are all able to communicate with more advanced Moral Societies and achieve a universal composite autopoiesis. The crucial part of autopoiesis is not physical (i.e., local) contact, but real-time exchange of quantum information.

In the crude type of interpersonal autopoiesis we have begun, we use classical modes of communication along with the quantum modes because we have not yet learned to effectively communicate in a purely quantum mode. This will not be the case with the Moral Society, which will maintain a classical mode of interacting within its star system but a quantum mode of interacting with other Moral Societies at other star systems. As the Moral Society evolves it enhances its star system and other Moral Societies, but more and more of its identity is contained within the collective intelligence of the Cosmic Moral Society that it is creating with the other Moral Societies through autopoiesis.

All existence is a manifestation of Information (F). Each of us is a message from the future. Each of us is a message from God to God. Eventually, the Moral Society will have an identity that transcends the local material universe and it shall become one with the Local Moral Society that created our universe. It shall become free of the entropic perturbations of matter, space, and time. It shall asymptotically become pure thought within the universe of all universes and manifest its creativity by creating new and better universes than the one that created it. In the process it will continue to engage in autopoiesis with other Cosmic Moral Societies and evolve forever within the never-ending hierarchy that leads to God.

The Option Everybody Has

Each of you has a choice to be a part of this process or to ignore it. The Game of Life is won by playing it—and lost only by refusing to play it. The first rule in the Game of Life, even before accepting the evolutionary ethic, is to assume full responsibility for your life and never again look for causes for your success or failure outside of yourself. If you can do this and then

accept the evolutionary ethic as the sole criterion by which you will order your life, you will automatically be led to recognize for yourself the steps that follow. "The Kingdom of God is within you." At each step you will have a choice, whether to take it or not take it. The choice is always yours. Only your own fear can keep you from taking the step.

Neither tyrannical governments nor the vagaries of the world can prevent you at each point in your life from making the choice to do that which you believe in your soul will maximize creativity. In doing so, you may die in a tyrannical society but you will never lose your quantum connection to God. You will live on in the creativity you engender in others. Each creative act enhances the creativity of the universe.

We are who we are because of the billions of choices our ancestors—from the first cells to our mother and father—took to produce us. We have the option either to continue the evolutionary process by choosing to play the Game of Life and continuing the uphill but ever easier struggle, or simply to stop struggling and sink back into the matter from which we came. If we choose to sink back into matter we will find many comforting delusions to make us happy along the way. We have the choice to never innovate or try anything new and always to play it safe—and in the process become extinct. Just as we have the choice to do our best, knowing that we may fail, to innovate that behavior in our life that we believe will maximize our creativity. There is no progress without risk. Those who refuse to take risks are guaranteed eventual extinction. Those who take risks for an ethical purpose have at least a better than even chance of becoming more creative. They will live on in the creativity which their actions engender in others. But the only risk we ever really take is the risk of being unhappy; both happiness and unhappiness are trivial.

What really matters in our life, our quantum connection to God, is never at risk unless we choose not to play the Game of Life. Only our own fear can keep us from playing. And our fear is an illusion. Fear is an illusion that we choose for ourselves when playing the Game becomes difficult. Fear is one response to those who punish us for playing the Game of Life. Playing harder is another response.

Those of you who have been so damaged that you cannot overcome your fear have my total compassion. I will do whatever I can to ethically help you overcome your fear. Those who have lowered their fear enough to begin creative transformation either alone or with others have my love and respect. I hope we can work together. Eventually all creative persons work together. That is how evolution catalyzes itself. That is how we engage in autopoiesis with God. The option is yours. As one of my favorite persons once said, *"Seek and you shall find. Ask and you shall receive. Knock and the door shall be opened."* The option is yours. If you choose to be creatively transformed, you shall succeed.

Epilogue

A Message From the Future

If the Ethical State cannot establish itself and survive in the United States, then it may possibly not survive in any other nation, because all other nations have less freedom than the United States. However, an Ethical State might start in other, less free nations by an act of ethical will from visionary leaders, as opposed to rising from the bottom by free choice as we have proposed. This is an unlikely, but not impossible, occurrence. That is, after all, how the United States started in the first place, when an ethical minority used its power at great personal risk to maximize creativity.

So long as the octets and their networks are allowed the freedom to progress, they should continue to work within the United States' system and focus on their ethical, educational, and economic development while having as few transactions as possible with the government, corporate monopolies, or other bureaucracies. Hopefully by positive example they will be able to help other Americans transform the United States into the ethical, free society it was originally intended to be in the Declaration of Independence. This would eventually lead to an Ethical State, which would in turn increase the true wealth and the creativity of all Americans, thereby making the Ethical State available to all humanity.

If this could not be done because of government interference, then all ethical persons would have little choice but to revolt, peacefully if possible, and become a sovereign nation. This would be an extremely high-risk venture, although their collective creativity might give them almost as good a chance as the Founding Fathers of the United States had when they undertook their extremely high-risk venture against the British Empire.

The Ethical State, as a state of mind that allows each person to take ethical action alone without having to be led by others, lives in the souls of all ethical persons. Every ethical person who wishes it is a citizen of the Ethical State.

On July 4, 1986, shortly after finishing the second draft of this book, while listening to some of the platitudes and clichés of our political leaders and rereading the Declaration of Independence, I thought of how far the leadership has degenerated since the time when Thomas Jefferson was our president. Thinking of Jefferson, I felt his soul touch mine. This inspired me to rewrite the Declaration of Independence. I wrote it in terms of today's realities, keeping as much of the original words and spirit of Thomas Jefferson as possible. This is what I believe Jefferson would say if he were alive today. It is a message from the future, with words from the past, received on July 4, 1986. It is a quantum event.

As we proceed in creative transformation we make ever greater and riskier commitments. The first is a commitment to the Game of Life. This is a commitment we make to ourselves, with no real risk. The second is to sign the Contract for Creative Transformation within an octet. This is a commitment to a few others, but with very little risk. The third commitment is to reject fear—a fearful act in itself. We make many more commitments. Eventually we make a commitment before the world to all humanity by becoming citizens of the Ethical State. This may have great personal risks associated with it. But the greatest danger that we ever incur comes when we tolerate destructiveness and do nothing.

Second Declaration of Independence

July 4, 1986
Inspired by Thomas Jefferson
Unanimously Agreed to by All Citizens of the Ethical State

When, in the course of human events, it becomes necessary for one people to dissolve the political bands which have connected them with another, and to assume, among the powers of the Earth, the separate and sovereign station to which the laws of nature and of nature's God entitle them, a decent respect to the opinions of humanity requires that they should declare the causes which impel them to the separation.

We hold these truths to be self-evident, that humanity is equal before God in being endowed by the Creator with certain unalienable rights; that among these are life, liberty, and the maximization of creativity according to the dictates of one's own conscience. That to secure these rights, governments are instituted among humanity, deriving their just powers from the consent of the governed; that whenever any form of government becomes destructive to these ends, it is the right of the people to alter or abolish it, and to institute new government, laying its foundation on such principles, and organizing its powers in such forms, as to them shall seem most likely to maximize creativity.

Prudence, indeed, will dictate that governments long established should not be changed for light and transient causes; and accordingly all

experience has shown that persons are more disposed to suffer, while evils are sufferable, than right themselves by abolishing the forms to which they are accustomed.

But when a long train of abuses and usurpations, pursuing invariably the same object, evinces a design to reduce them under any form of despotism, it is their duty to throw off such government, and to provide new guards for their future creativity.

Such has been the patient sufferance of the subjects of this government, and such is now the necessity which constrains them to alter their former system of government. The history of the Government of the United States is a history of repeated injuries and usurpations, all having in direct object the establishment of tyranny over these now-free people. To prove this, let facts be submitted to a candid world.

The Government of the United States, in collusion with the vassal governments of states, counties, and municipalities, have usurped the power originally granted by God and the Constitution of the United States to the people, and imposed destructive taxation, an inequitable legal system, an oppressive, compulsory educational system, and insufferable interference in their private lives.

The elected officials have repeatedly lied to the public in order to obtain their support in further reducing their liberty. A majority of the electorate has repeatedly shown itself willing and anxious to be deceived, by voting for the most deceitful of the political candidates before them. A majority of the electorate has repeatedly rejected ethical candidates who refused to lie to them. The Government of the United States and a majority of the voters have shown that the United States' system of government is a failed ideology which leads to the concentration of power in the hands of the most destructive liars that the society can produce. The possibility that all other systems of government have in the past been even worse does not justify any form of destructive tyranny. We seek the best possible form of government, and not merely the lesser of popular evils.

The Government of the United States has shown its moral bankruptcy by squandering the wealth of its people in supporting some of the most corrupt, destructive tyrannies in history. Among these have been the governments of the Soviet Union between 1941 and 1945, the Republic of China (now in Taiwan) since 1941, the Shah of Iran from 1953 to 1978, South Vietnam from 1956 to 1975, the dictatorship of Ferdinand Marcos in the Philippines from 1966 to 1986, many despotic Islamic states in the Middle East and Pakistan from 1949 to the present, plus many evil, destructive dictatorships in Africa, Asia, and Latin America, whenever it has seemed politically expedient, during most of the latter half of the twentieth century and still today. This destructive expediency has allegedly been practiced to inhibit the deleterious spread of even greater evils, particularly Communism. But it is self-evident that unethical means can never achieve

ethical ends. Confiscatory socialism and other evils have steadily spread and become stronger through the unethical acts of the United States Government. This Government now gives aid and support to the largest communist government in the world, the People's Republic of China. Humanity is now closer to self-annihilation than at any time in history.

The Government in its alleged attempt to defend its people has taken away their liberties and has almost succeeded in destroying them along with the rest of the world.

The Government and a majority of the electorate of the United States have engaged in gross fiscal mismanagement. They have continued to cause the national debt to grow until it now amounts to over $10,000 for each man, woman and child in the nation. At the same time, they have impoverished the creative people of the United States by confiscating their wealth and redistributing it to the most destructive persons in the nation, thereby spawning a new parasitical class of bureaucrats, monopolies, oligopolies, and their clients, who further destroy the creativity of the nation.

The Government of the United States has constantly expanded its police powers through the Central Intelligence Agency, the Federal Bureau of Investigation, the Internal Revenue Service, the Immigration and Naturalization Service, the Drug Enforcement Agency, and other bureaucracies to spy upon and harass its ethical citizens with police state methods, while selectively aiding and abetting the ever more destructive organized crime syndicates at home and the tyrannies abroad. In gross violation of their civil and human rights, the Government has made it increasingly difficult for ethical citizens to arm and defend themselves, while simultaneously contributing to the proliferation of vicious criminals by supporting and expanding a legal system that punishes the ethical and rewards the unethical. These destructive practices are exacerbated by the rulings of the Supreme Court, which constantly take away individual liberty for the benefit of the police bureaucracies and for political expediency, by catering to popular fear and prejudice, while protecting criminals at the expense of the innocent.

The legal system itself is dominated by parasitical lawyers who corrupt the law to serve solely their own power-seeking and money-making purposes by constantly eliminating all vestiges of truth and justice from the legal process and replacing them with legal technicalities, bureaucratic procedures, and the deception and manipulation of ignorant, fearful jurors. In the current legal system, money, deception, and/or a clever, unscrupulous lawyer can always prevail over truth and justice.

The Government of the United States, with the criminally negligent acquiescence of an electoral majority, has plundered the wealth of its citizens, imposed upon them an ever growing oppressive government, exacerbated the pollution and destruction of the environment, destroyed the creativity of its youth through a malignant educational bureaucracy, and made

it ever more difficult for individual creativity to express itself. The Government has greatly endangered the very survival of humanity and life on earth. The political leaders of the United States, and those who vote for or in any way support them, have shown themselves unwilling to change the situation to provide for the common welfare and prevent the destruction of the people's God-given creativity.

In spite of all its faults, we recognize that the Government of the Unites States is among the least evil governments on earth. But just as the United States was originally created when an ethical minority of its inhabitants revolted against what was then the least evil and most powerful government on earth in order to not be forced to accept the lesser of evils, so now must a new ethical minority revolt against the least evil and most powerful government of today. For evil in any form, no matter how powerful, must not be tolerated. We recognize along with those who signed the original Declaration of Independence that all governments are inherently evil; only that government which governs least, governs best. We have used the remaining liberty in the United States to warn our American brethren of these dangers through our words and our actions; we have given alternatives. They have chosen to continue on the path of self-destruction.

We, the People of the Ethical State, choose life over death. We choose creation over destruction. In ethical self-defense, we declare ourselves a free and sovereign people, no longer bound by any ties to any government other than our own. We welcome those who choose to join us in a creative, free society. The Ethical State begins. We shall create a Moral Society.

Before the world and the God who created all, we declare ourselves an Ethical State dedicated to the maximization of creativity and bound by no other law. We declare the inviolate liberty of every human being to do and say what he or she pleases as long as he or she does not impose undeserved harm on another. We declare that harm to another is deserved only when necessary in self-defense against the person harmed. A person's life and property belong entirely to him or herself; no one has a right to any part of another person's life or property. Only mutually voluntary transactions can ever be ethical or creative. The tyranny of any majority over any individual is hereby denounced. We, the People of the Ethical State, swear eternal hostility against *every* form of tyranny over the mind of any ethical being. We declare all persons ethical until proven otherwise.

Upon these principles we shall henceforth govern ourselves and interact with others. We shall do our best to maximize creativity. Toward this God-inspired end, we, and all future citizens of the Ethical State, pledge our lives, our fortunes, and our sacred honor.

PART III

Additional Information

Appendix

The Creative Transformation Experiments: A Do-It-Yourself Guide

The initial Creative Transformation experiment was described in Chapter 5. After this, a series of alternative experiments were done to see if persons could learn the Creative Transformation process and have similar subjective experiences without having to invest six days of their time. These were done by trial-and-error and intuition. They ranged from three-day seminars to no seminars or preparation at all. And from absolutely no screening of the participants to much more initial information and mutual evaluation for the participants than for the first group. After ten of these trial-and-error experiments we found what seemed to be an ideal compromise. We then did thirty more of these optimized experiments, thirteen between 1984 and 1986 plus seventeen more in 1987 and 1988. A different type of experimentation began in 1989 in other countries as well as the United States; it has not yet been fully evaluated, although it seems to support the previous findings.

We have evaluated the creative transformation experiments by the subjective reports of the participants, a context analysis of autopoiesis, by how long persons continued to participate in an octet after the weekend seminar, and by the objective creativity changes of those who have been in the process for two or more years. A proper long-term evaluation would, of course, involve measuring changes in objective creativity before and after beginning creative transformation as compared to statistically matched groups that have not engaged in creative transformation. More elaborate experiments would have to involve placebo control and random assignment of subjects to control and experimental groups. In the beginning it seemed to be a considerable success to be able to get an octet to continue autopoiesis and live up to the creative transformation contract.

There follows a statistical summary of the results on 260 creative transformation participants from August 27, 1984, to December, 1988, when the last experiment of this type ended. Since that time we have been working with established octets that grew out of and evolved from the initial experiments and doing new experiments along the lines recommended

later in this Appendix. These bear out and support the following conclusions:

The initial creative transformation experiments have run their course; it is now clear how best to use this technology and what to expect from it. The creative transformation process is an amplifier. It can make the creative more creative but it can not reverse overall destructive behavior for unethical persons. Indeed, extremely fearful persons seem to be made even more fearful by the anticipation of autopoiesis. Autopoiesis itself causes serious discomfort apparently only in schizophrenics. A seriously disturbed paranoid schizophrenic thought she was going to die, although she was in no way harmed. A psychotherapist who claimed to be "schizoid" forced herself to engage in autopoiesis because her husband found it very worthwhile. Both she and her husband were professional psychotherapists. She quickly stopped the process and claimed it exacerbated her schizophrenic tendencies by lowering barriers between herself and others. She felt that, if she had not feared the schizophrenic tendencies in herself, she would not have found autopoiesis so disturbing. However she was in no way harmed by autopoiesis. Another woman who had had a "nervous breakdown" one year earlier had great anxiety before autopoiesis, but she reported a positive experience of autopoiesis after she tried it. Persons should have no problems with autopoiesis if they are healthy, but schizophrenics in general and paranoids in particular should avoid it. It is my best judgment that no one can be harmed by autopoiesis. Of the approximately 300 persons who have engaged in autopoiesis at least once, approximately 75% found it subjectively worthwhile while 25% found it a neutral experience. There were no other reported experiences. Approximately 50% of those who engaged in autopoiesis tried it two or more times, and approximately 25% tried it four or more times. Approximately 10% are still engaging in autopoiesis on some basis. For most persons the effects of autopoiesis will begin to diminish within a few trials. Many had expected quick economic returns, although no such promises were made, and were disappointed when these were not forthcoming. One group of eight, which was distilled in 1985 from five groups of eight, which were meeting on a regular basis, is still meeting today. However, some persons seem to get immersed in autopoiesis as a purely subjective experience and do nothing objectively creative with it. There are approximately twenty persons who are currently involved on a long-term basis with creative transformation for objectively creative purposes. Several inventions, patents, and other creations have been produced by a single octet, but for over ninety percent of the randomly selected participants there do not currently seem to be any lasting long-term benefits.

Of the eight who do meet most regularly, all but one claim a significant increase in creativity and a significant decrease in fear. The one exception in the group still finds the process extremely worthwhile in an emo-

tional sense. He was and remains a highly creative person. It seems that each person in the group got out of it whatever she or he most needed. The one who got the least out of it needed the least but helped others. The ones who put most into the process get the most out of it. The more we give others, the more we receive from the process. If we give nothing, we receive nothing. Autopoiesis is of zero value to those who decline the Game of Life.

The viability of any group depends on the members. A group can usually cope with one highly fearful person by helping that person to change or indirectly inducing the person to leave the group. Two or more highly fearful persons will usually lead to the group's disintegration, but the most creative members will reorganize themselves into another group. Once a group has passed the threshold where no one in the group is afraid of anyone else in the group, it begins to make rapid progress in its own integration. If the initial members are properly chosen, then it should take the group about one or two years to reach irreversible creative transformation. The single best initial screening technique for autopoietic groups is that they thoroughly understand this book and fully commit to play the Game of Life.

The groups-of-eight concept (octets) seems a valid and probably optimal way of organizing persons for any enterprise. If the enterprise requires more than eight persons to succeed, then a cooperative of several autonomous octets should be created. Autonomous organizations should not be much larger than four men and four women, if they are going to maximize creativity. However, much more detailed and controlled experimentation remains to be done on the process of creative transformation. The preliminary indications are that the theory is essentially correct and that it will work with persons who are screened by the process as given in this appendix. It will probably never work for persons who can not pass the the initial screening. Remember that the screened persons eliminate themselves. The process itself continues to screen persons out.

From the preceding experiments we have modified or restructured our experimental techniques and the seminar process itself. Persons who have read and understand this book are allowed to begin the seminar with no other preparation. Persons who have not read this book are invited to one of the four hour audio-visual presentations and then asked to read and understand this book. If they are then interested in participating in the seminar, they submit an application to attend. We try to match persons by compatibility and geography, then follow up with studies to see what kind of persons get the most out of the creative transformation process.

In two evenings and two days, everyone who passes the self-screening process is taken through the first four steps of creative transformation so that they can continue it on their own, usually in the same octet in which they participated during the weekend seminar. Persons who have read this

book and wish to take the four hour audio-visual presentation prior to the weekend seminar are invited to the four hour audio-visual presentation after verifying by telephone that there is room. The following materials are currently sent to persons who inquire about our seminars or about working with SEE. They are similar to the materials sent to the original experiment participants.

Applicant Letter

Dear Applicant:

Thank you for your interest in participating in our creativity experiment. Briefly, the experiment consists of taking some experimental courses and laboratories in group creativity in groups of at least four men and four women but rarely more than sixteen men and sixteen women. The courses and laboratories will be given for two days at a private country home near Eugene. The courses begin at 8:00 PM on an evening of your choice and end within two days. You will be provided with room and board during this period but no salary. Participants who show high creativity and wish to join SEE may be offered positions with SEE plus the opportunity to be partners with SEE in enterprises financed entirely by SEE. One year work-study scholarships with SEE are also available. However, nothing is guaranteed or promised at this time.

Single persons will be provided with dormitory accommodations. Couples may have a room and bath to be shared with one other couple. The gardens, library, classical music room, shops, and other accommodations will be fully available to all participants.

The experiment consists of learning a generalized theory of evolution and ethics and how to apply it to solve practical problems. Problem-solving sessions will be held each day. The final exercise will focus on a very difficult problem that requires considerable creativity to solve. The participants will be thoroughly briefed and debriefed after each exercise. The entire two days should be a pleasant learning experience in a very agreeable surroundings for all participants. Each participant will at all times be made as comfortable as possible and treated with courtesy and respect. We request that you sign the preliminary contract for Creative Transformation (attached) before being invited to stay for the weekend.

The program is an experimental procedure for enhancing individual creativity within small groups of eight to sixteen persons. SEE cannot guarantee that every participant will have his or her creativity significantly enhanced. However, that is the purpose of the experiment. The minimum that SEE can guarantee you is that if you are selected to participate in this experimental program you will have a pleasant, interesting, and creative vacation in beautiful surroundings at no cost to you. At best you will have your creativity greatly enhanced so that you can be creative in entirely new

dimensions of activity. Whatever happens, you will significantly contribute to your and humanity's understanding of the process by which we discover scientific laws, invent machines, create works of art, and help others to do the same.

If you wish to participate in the experiment, please fill out and return the enclosed form and contract. A prerequisite for participating in the experiment is that you read *Creative Transformation* by John David Garcia and take our four-hour course—*Creativity, Ethics, and Evolution*—at no cost to you. The course will be given at a time and in a location hopefully convenient for you. This four-hour course will give you a clear indication of how and why the experiment is being run and the theory behind it. You may buy or borrow *Creative Transformation* after taking the free course.

Please call or write if you wish to explore further your participation in SEE's experimental program for enhancing creativity. When we receive your completed application, we will invite you to attend the first course that is convenient for you.

School of Experimental Ecology
P.O. Box 10851, Eugene, Oregon 97440
503/937-3437

Information for Creative Transformation

A Two-Day Experimental Course and Workshop
Designed To Help You Achieve a New Dimension in Creativity
by JOHN DAVID GARCIA, Inventor and Author

The course is given at the School of Experimental Ecology (SEE) at its country home in Fall Creek, Oregon, beginning on an evening of your choice and ending two days later at 5:00 P.M.

Admission is by pre-enrollment only. Although the course is for a general audience, it is recommended that applicants read and understand *Creative Transformation* before taking the four-hour introductory course, *Creativity, Ethics and Evolution,* which is given by SEE periodically in the afternoons at 1:00 P.M. at the SEE country home in Fall Creek, OR, prior to the workshop. Applicants are admitted to the workshop only after understanding *Creative Transformation* and taking *Creativity, Ethics and Evolution*.

The workshop will teach participants how to apply the principles of Creative Transformation to their own personal lives and to the lives of persons with whom they interact in such a way that their own creativity and that of others is maximized. All participants will be provided with transportation between Fall Creek and the Eugene, Oregon airport, plus points in between.

The first teaching session consists of discussing *Creativity, Ethics and Evolution,* which all participants will have previously studied. When the Session is over, the participants arrange themselves into one or two teams of four couples each. There will be at least four men and four women but not more than sixteen men and sixteen women participating in the course. Part of what is taught is how men and women complement each other in the creative process.

Three creativity exercises will be performed. The first two exercises will apply creative ethics to solving a whole gamut of problems that persons may encounter in their lives, focusing on education, economics and other social problems. The third exercise will illustrate and use a technique for integrating four couples into a creative, collective intelligence capable of solving problems that none of the individuals can solve alone.

All three exercises will be thoroughly discussed and analyzed by all the participants before and after each exercise. The exercises themselves are structured as applications of Creative Transformation.

The two-days will be spent at SEE's country home, a pleasant 10-room, 3½-bath, 3,100 square foot home with a large garden, library, music room, and many other amenities. All facilities of SEE are available to all course participants. The home itself is located on a creek in a beautiful, quiet, secluded river valley in the midst of hills, Douglas fir forests, and fields. Walking tours of the gardens and creek will be held each day for those who wish to take them. Participants should bring comfortable, casual clothes for two days and two nights. Bring rubber boots during the rainy season if you wish to take walks. Persons wishing to swim in the creek (summer only) should bring a swim suit. All instruction, room, board, facilities, and transportation are free to persons participating in the experiment.

If the experiment is successful, you will become significantly more creative, and SEE will learn how to better educate its students. After further discussions and interviews, successful participants may be offered positions or affiliations with SEE. However, nothing is guaranteed.

Application for Admission

The following application is for the two-day experimental course, Creative Transformation, given by the School of Experimental Ecology at its country home in Fall Creek, Oregon. Filling out this form and meeting the prerequisites are not guarantees of admission. You will be interviewed by a member of the SEE staff to see if you can be integrated into a group beginning on your preferred dates.

____

Last Name First Name Middle Name Phone

____

Street City State Zip

____

Sex Height Weight Age/Birthdate Health (poor to excellent)

Are you applying as a: Single _____ Couple _____ Group _____

If you are applying as a couple or group, each person must complete an application. Please attach them together and submit.

What is the highest educational level you have achieved? ____________________

____

What were (are?) your principal areas of study, formal and informal: ________

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List your three favorite books, and briefly state why: ______________________

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List the last three books you have read with dates: ______________________

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Have you read *Creative Transformation*? (yes or no) ______________

Do you thoroughly understand *Creative Transformation*? (yes or no) ________

List your three favorite musical compositions or composers: ______________

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List your three favorite works of art or artists: ______________________

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List the three most important achievements of your life: ______________

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List the three things you would most like to achieve in the future: ____________

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List your hobbies and non-professional interests: ________________________

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What is your current profession? Attach resume, if available. ______________

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What are the three most important kinds of work you have done outside your profession? ____

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Do you have children? If yes, please give ages: _________________________

Briefly summarize your lifetime creative achievement to date and your hopes for the future; add more sheets if necessary: ______________________

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Do you wish additional help to understand *Creative Transformation*? (yes or no) ____

Preferred dates of attendance for *Creativity, Ethics & Evolution:* ____________

____

Preferred dates of attendance for *Creative Transformation:* ______________

____

______________________________________ ______________
Signature Date

Information About SEE

The School of Experimental Ecology (SEE) is a research and development organization dedicated to maximizing creativity. Creativity is, among other things, the process by which we discover scientific laws, invent new machines, produce works of art, or help others do the same. The most creative thing one can do is help maximize the creativity of another. In the process we maximize our own creativity. SEE accomplishes its purpose through education and the development of new technologies. The objective is to discover, through experimentation, how to optimize personal creativity by modifying the ecology or total environment—physical, biological, and psychosocial—of each person, so as to maximize that person's creativity. SEE offers the following programs and activities for the benefit of its members and the public:

1. An intensive four-hour audio-visual presentation, seminar and workshop on creativity, ethics, and evolution. An outline of this free, open, periodic presentation is attached.
2. A two-day and two-night free workshop and laboratory on how to apply the principles of the above presentation to increasing creativity personally for oneself and for groups.
3. Writing and publishing books and other materials for communicating the findings of SEE to the general public; this includes developing a new, holistic primary-to-Ph.D. curriculum.
4. Developing inexpensive technologies and skills for educational, housing, food, energy, and health self-sufficiency for groups of about eight adults and their children on very small farms and on marginal forest lands.
5. Helping scientists, inventors, artists, and other creative innovators organize their skills and resources so that they can become economically independent and maximally creative within SEE.
6. Research and development of radical new technologies in computers, communications, energy, health, education, etc. that can be implemented in a bootstrap mode without outside financing.

SEE is entirely self-financing through the creativity of its members. No fees are sought or accepted for SEE's services. Instead SEE works in a cooperative manner with its members and associates to create works of art,

start new enterprises, and develop new inventions. SEE's sole income comes from sharing in these creations and from anonymous, unsolicited contributions.

SEE was started in 1981 and is still headed by John David Garcia, an author and a successful scientist-inventor of many new technologies and devices. Enterprises started and inventions created by John David Garcia have had sales in excess of one billion dollars. Yet profitability is neither a goal nor a constraint on SEE's activities. SEE's sole goal is to maximize creativity.

Creativity is the basis of all wealth. But wealth is regarded by SEE as an essentially trivial side effect of creativity. The only reason to associate with SEE is to increase creativity. SEE considers neither wealth nor security in its decisions.

If you wish to know more about SEE, you should read books by John David Garcia, particularly *Creative Transformation,* which are available in many libraries, through Whitmore Publishing Company in Ardmore, Pennsylvania, or through SEE itself. You are also invited to apply for admission to any of SEE's free seminars or workshops. Only persons who have taken the free seminars and workshops, read SEE's materials, then thoroughly understand and share SEE's goals, purposes and methods are invited to become members and associates. There are no other prerequisites.

School of Experimental Ecology
P.O. Box 10851, Eugene, Oregon 97440
503/937-3437

CREATIVITY ~ ETHICS ~ EVOLUTION

A Four-Hour Audio-Visual Presentation on Creative Transformation

by John David Garcia, Inventor and Author

Seminar Outline and Agenda

PART I A GENERAL THEORY OF EVOLUTION

A. The Evolution of Matter

1. The Origin of the Universe
2. The Evolution of the Galaxies
3. The Evolution of the Stars
4. The Evolution of the Planets
5. Entropy and Evolution
6. Chemical Evolution
7. Self-Reproducing Molecules
8. Autopoiesis

B. The Evolution of Life

1. The Cellular Synthesis
2. Specialization & Generalization
3. Natural Selection
4. Punctuated Equilibrium
5. Embryological Recapitulation
6. The Fossil Record
7. The Neural Primacy
8. Brain Evolution

C. The Evolution of Intelligence

1. What Is Intelligence?
2. Intelligence and Natural Selection
3. Human Versus Animal Intelligence
4. Computers and the Brain
5. The Components of Intelligence
6. Imagination and Creativity
7. Ethical Intelligence
8. The Problem of Creativity

D. Discussion and Recess

PART II CREATIVE MIND

A. The Evolution of Mind

1. Mind and Intelligence
2. Mind/Body Problem
3. Autopoiesis and Consciousness
4. Creativity and Consciousness
5. Creativity and Ethics
6. Mind and Evolution
7. Creativity and Evolution
8. The Game of Life

PART II CREATIVE MIND (continued)

B. The Evolution of Ethics

1. Survival, Ethics and Evolution
2. Subjective Ethics
3. Objective Ethics
4. The History of Ethics
5. Ethical Singularity—6th Century B.C.
6. The Christian Synthesis
7. Religion and Entropy
8. Spinoza and Moral Science

C. Discussion and Recess

PART III CREATIVE TRANSFORMATION

A. Collective Intelligence

1. Supermetazoan Intelligence
2. Human Organizations
3. Ethics and Organization
4. Creative Organization
5. Bureaucracy and Entropy
6. Optimization of Organizations
7. The Problems To Be Solved
8. How To Begin

B. Collective Creativity

1. Personal Transformation
2. Ethical Dynamics
3. Fear and Love
4. Quantum Mechanics and Consciousness
5. Science and Mysticism
6. Evolution by Complementary Pairs
7. Human Autopoiesis
8. The Moral Society

C. Discussion and Recess

D. Open-Ended Discussion

NOTE: The audio-visual presentation takes exactly four hours. Discussions and Recesses will add a variable amount of time to the presentation which may be in excess of one hour. Persons with questions should write to SEE or call 503/937-3437.

Preliminary Contract for Creative Transformation

(Used only in some later experiments after January, 1988)

For the next forty-eight hours I promise to do the following to the best of my ability:

1. Maximize my creativity and that of all persons with whom I interact.

2. Assume that I and I alone am responsible for everything I do.

3. Speak the truth, the whole truth, and nothing but the truth on any matter that may affect my creativity or that of others with no concern about anyone's happiness.

4. Assume that my feelings and intuition about anyone's state of mind reflect my own state of mind, not necessarily anyone else's state of mind; as a consequence I will not judge other persons' ethics, motivations, or personality but refer solely to their objective behavior regarding how to improve their creativity or meet my personal needs.

5. Abstain from all food not provided by SEE as well as all drugs including alcohol, tobacco, and coffee—unchlorinated well water is the only beverage provided together with wholesome, organic, predominantly vegetarian meals.

6. Be non-destructive, kind and courteous to everyone, while following the equally non-destructive, kind and courteous directions of the Creative Transformation instructor.

7. Abstain from speaking of myself or my experiences unless I am asked a direct question, in which case I will answer as clearly and concisely as possible solely with information that is significantly relevant to the questions and with no other information.

8. To promptly, unilaterally abrogate this contract, thereby making it null and void, and leave SEE after giving my full true reasons for doing so to the Creative Transformation instructor and to any others whom I wish to inform, if I in any way see, feel, believe, or intuit that my or anyone else's creativity is being diminished by the Creative Transformation Process; otherwise I agree to stay the full 48 hours.

In return for my promise to abide by the above eight conditions, I will receive free room, board, and instruction at SEE during the next 48 hours, while being taught the Creative Transformation Process as a gift for me to keep, use, and modify as I see fit, except that if I modify it in any way, I will no longer call the process "Creative Transformation," which is a process invented by John David Garcia.

I further agree that if I violate any of the eight commitments above, I may be asked, politely, to leave SEE by the Creative Transformation instructor, who may be the sole judge of whether my behavior is violating

the terms of this contract. If I am asked to leave, I will do so promptly, causing minimal disruption to those still participating in the process. At that time this contract will be null and void. Therefore, this contract may be unilaterally abrogated at any time by either party by giving notice to the other party as indicated and giving the reasons for the abrogation. The agenda for the next 48 hours is approximately as follows:

1. Prepare and have supper. (This and all other meals are predominantly vegetarian.)
2. Introduction, review, social, and light dance-exercise.
3. Sleep period of at least eight hours.
4. Wakeup at 7:00 A.M.
5. Light dance-exercise at 7:30 A.M.
6. Prepare and have breakfast.
7. Lecture and discussion on how to apply the Evolutionary Ethic.
8. Workshop on the above.
9. Prepare and have lunch.
10. Review of Workshop.
11. Lecture and discussion on the ethical meaning of "Love" as it relates to creation.
12. Workshop on the above.
13. Prepare and have supper.
14. Review of Workshop.
15. Lecture and discussion on the ethical meaning of "Fear" as it relates to destruction and impedes creativity.
16. Workshop on the above.
17. Sleep period of at least eight hours.
18. Wakeup at 7:00 A.M.
19. Light dance-exercise at 7:30 A.M.
20. Prepare and have breakfast.
21. Discussion of last workshop and the problem of fear.
22. Lecture, discussion, and demonstration of classical and quantum mental processes.
23. Workshop on the above (Quantum Dialogue).
24. Prepare and have lunch.
25. Lecture and discussion on last Workshop and Autopoiesis.
26. Autopoiesis Workshop.
27. Discussion and farewell; over by 5:00 P.M. End of Agenda.

I certify that I have never been under the care of a psychiatrist, nor had any professional or authoritative recommendation that I have psychiatric care, nor ever had any experiences that might have required psychiatric care. I am to the best of my knowledge mentally and physically healthy. I am not under the regular care of any health professional at this time nor am I using any kind of medication, drugs, or medical diet.

If I cannot attest fully to the veracity of the previous paragraph, I hereby submit a certificate of my eligibility to participate in the Creative Transformation process that has been signed by a licensed health professional claiming to be competent in this matter. I understand fully and accept that although the Creative Transformation process seems to be harmless and unstressful for almost all fully healthy persons, it may produce stress and even distress in some persons who are not in full mental or physical health and possibly in others. I fully understand and accept that Creative Transformation is still an experimental process whose side effects are not fully understood. I have been informed as follows:

"Of over three hundred persons who have gone through the Creative Transformation process, only one showed extreme emotional and possibly physical distress; that person appeared to be a seriously disturbed paranoid schizophrenic, whose symptoms did not show in the beginning. Three other persons did not show distress but showed some stress. One claimed to be a schizophrenic. Another claimed to have had a 'nervous breakdown' a year earlier. The third appeared to be a healthy woman who had a lot of job-related stress in her life; when she recovered from her stress, about five months after the workshop, she asked to make a full commitment to work with SEE. Such highly vulnerable persons should not participate in the process without full informed consent. All other participants in the Creative Transformation process report only positive experiences. If you are emotionally or physically fragile, you should not participate."

I promise to hold the School of Experimental Ecology and all its associates blameless for any harm that may befall me as a consequence of events of the next 48 hours. I finally promise to leave any facilities I use during the next 48 hours as I found them.

____
Printed Name

____
Signature Date

School of Experimental Ecology
P.O. Box 10851 Eugene, OR 97440 Tel. 503/937-3437

How To Repeat the Experiments

Before I wrote this book, participants in the Creative Transformation experiments, in addition to always taking the four-hour course, were often required to read *The Moral Society,* occasionally also *Psychofraud and Ethical Therapy,* and always a set of notes, similar to the last half of the Introduction to this book, before or during the Creative Transformation weekend seminar. Although the four-hour course, the other books, and the notes have their own value, this book is a better preparation for the Creative Transformation weekend seminar than all the other publications combined. The best way to screen participants is with this book.

You should now have a good idea about how the original experiments were performed. I hope that you and others will repeat them and verify them. You should get very similar results if you follow the following outline, which is a recommended approach reflecting SEE's experiences; feel free to improvise on it and change it to what you think is best.

1. Preselect all participants in the experiments as follows:
   (a) Choose only those who have read and understand this book;
   (b) and who have made a signed commitment to play the Game of Life, and to participate on the specific dates indicated.
   (c) Persons wishing to participate together in the experiment should be kept together in the same octet.
   (d) Do your best to match applicants so that those with similar interests, backgrounds and geography participate in the same octet.
   (e) Personally interview all the applicants and make your best judgment as to which applicants will work best together. Neither break up couples nor try to create couples unilaterally. Just put compatible persons together. All participants should at least sign the preliminary contract to abide by the rules of the Game of Life. If they are not sincerely committed to the Game of Life, they will fail and impede the success of others in the experiment.
   (f) Do not refuse anyone who wishes to participate, just make sure they are properly matched; it is particularly important to put all those who are unlikely to play the Game of Life into the same octet and protect otherwise viable octets from them.

2. Invite at least four men and four women, but preferably not more than sixteen of each, in matched groups of participants to spend two nights and two days together taking the workshop at a quiet comfortable location where they will not be disturbed nor charged.

3. Begin the workshop no later than 8:00 P.M. of the first evening. Use the first evening primarily to introduce all the participants to each other and let them give their reactions to this book to one another. Let them know what will be happening over the next two days. The participants will at this time divide all the housekeeping chores for the weekend among themselves on a voluntary basis.

4. To end the first evening, have a half-hour dance set to European medieval dance music. Begin with a circle dance involving all the octets, then have all the octets break into separate circle dances among themselves. Within each octet eventually make two circle dances one within the other for each quartet. They then rotate in opposite directions. Let the quartets become octets again and then let all the octets join together again in a large circle. You personally should improvise the choreography for the circle dances to reflect the Creative Transformation symbol. The entire circle dancing should take no more than fifteen minutes. The last fifteen minutes should be spent in free form dancing where all the octets and individuals can do whatever they wish.

5. A staff member gives the wake-up call at seven A.M. Repeat the free-form dancing for one half hour each of the remaining two mornings, after a brief circle dance.

6. Prepare and serve breakfast using only participant labor. The participants who have no cooking skills can do the cleaning and KP duties. Have either one large table for everyone, or, better still, a circular table for each octet and one staff member. There should be not more than one staff member for each octet. They will substitute in the octets if any of the participants fail to show up or leave early.

7. Begin the first seminar soon after breakfast. Spend no more than half an hour going over the meaning of the Game of Life and orienting the participants about which of the three ethical problems in Sex, Education, or Economics they will solve by applying the evolutionary ethic and the eight ethical principles. Each octet decides by consensus which problem it will work on. Use no more than 15 minutes to reach a consensus. Once consensus is reached then let each octet, sitting in a circle, spend until lunch time, with no more than a 10 minute break, working on the problem. Each octet designates by consensus one facilitator to record and report to everyone what their octet's consensus was regarding the problem on which they focused. The facilitator can ask questions, recognize speakers, but give no opinions. This exercise is intended to synchronize the neocortex.

8. End this problem-solving session at noon and break for lunch. Have one half-hour group walk or swim for those who are not responsible for cooking and serving lunch.

9. Serve lunch after the walk. Have those on KP clean up.

10. Begin the next seminar soon after lunch. At this time one reporter from each octet gives the consensus for his/her octet. This is freely discussed, questioned and commented on by all the participants. When the

discussion is over all participants will have a minimal synchronization of their neocortex. They are guided by the staff in how to synchronize their mammalian cortex by making a commitment of love to one another. Each octet will discuss together the contract for creative transformation and by consensus either sign this contract or any revision of their own choosing. There is then a ten-minute break before the octets sit again in discussion circles and again designate a facilitator. The discussion circles remain in session until they have reached consensus on what commitment of love they are willing to make to each other. They then sign this commitment. After all have signed the commitment of love, each person in each octet holds both hands of each other person in the octet, one person at a time, and says, while looking into the eyes of the person, "I promise to do my best to maximize your creativity." (See pages 255–56.)

11. Supper is prepared and served by the participants after the commitment is signed, the oral commitment is made, and the mammalian cortex is synchronized.

12. The next seminar starts soon after supper. The facilitator for each octet indicates what commitment of love they were able to make to one another. The commitments are discussed by all the participants. After this discussion, the staff person begins discussing the problem of fear and how to overcome it. All the participants give their ideas on the subject until 9:30 P.M. At this time the participants are asked to sleep on the problem of fear and dream about how to overcome it.

13. Staff member gives the wake-up call at seven A.M. The free-form dancing is repeated for one half hour.

14. Breakfast is prepared and served by the participants soon after the dance.

15. The next seminar begins at 9:00 A.M. Participants discuss their conclusions and ideas about fear. Staff members may ask clarifying questions. This goes on until 10:00 A.M. The participants will have their R-complex synchronized by a common understanding of fear, if they can reject fear as a motivator. Now a staff member discusses the Quantum Dialogue and how it can be used to make us aware of our Quantum Connection. The staff member gives a demonstration of quantum responses to questions asked by the participants. Then, there is a ten-minute break and the octets reassemble into their discussion circles. Within each octet, by consensus, each member gives quantum responses to questions asked by the other seven members, until all members feel personally that they understand the process of the quantum dialogue and can distinguish between a classical and a quantum thought. This process ends by consensus. (See page 260.)

16. Soon after the Quantum Dialogue, there is a group walk or swim for those who wish to take it and are not involved with lunch preparation.

17. Lunch is then served, followed by a half-hour cleanup.

18. Soon the next seminar starts. The Quantum Dialogue and Autopoiesis is discussed. Emphasis is put on how to avoid mixing quantum and classical thoughts as in the section on Autopoiesis and Fear in the introduction to this book. All participants are asked to focus on the same problem during autopoiesis, namely how we all can optimize the process of creative transformation, or how to solve another problem on which the octet has decided to focus by 100% consensus. To help the focusing process they are asked to visualize the problem as a bright star in a dark sky. If their attention wanders merely refocus back to the bright star and focus on what they can tell their seven teammates as to how to optimize the creative transformation process. We say what we believe is important while focused on the problem and do not worry about whether it is logical, coherent, intelligent, or even relevant. We listen to our quantum connection and let it guide us.

After this preparation, which should not take longer than one half hour, each octet removes its shoes and socks and is seated in separate rooms in a small circle on comfortable chairs with good back support, alternating males and females, short-legged people across from long-legged ones. Each person then holds the hands of the persons next to him/her, and touches with his/her feet the feet of the two other persons of the opposite sex seated diagonally opposite. (See pages 36–42 and 261–68.)

Although all this seems difficult to do at first, it is really quite easy, as the diagram on page 37 shows. After persons are in a comfortable position, a staff person puts on a good recording of Bach's *Art of the Fugue*, at a barely audible level. I recommend the Munchinger's recording on London. (See pages 36 and 264.) The recording by Ristenpart on the Nonesuch label is my second choice.

Once the autopoiesis starts it is important that there be no disturbances or interruptions and that the participants remain comfortable. Within ten to twenty minutes some of them should begin having quantum thoughts and images. These are not necessarily the second thoughts or images, but more often the first during autopoiesis. Those who think in terms of images should describe their images. The others should share their thoughts. Remember, it is always better to say nothing than to speak from the classical brain during autopoiesis. Be guided by your sincere desire to say what will maximize the creativity of the other participants and forget your ego. The failures in autopoiesis are never because persons say too little but because they say too much. Anyone who refuses to be guided by fear will eventually succeed in autopoiesis, even if he/she says nothing in the first few tries. To say nothing is not a failure, it is a success.

Anyone who wishes it, for any reason, should stop the autopoiesis at any time. It is important that anyone who is uncomfortable in the beginning rearrange the situation until he/she and everyone else is comfortable, then restart the autopoiesis. Persons should also rest their hands so that they are comfortable from the start. In spite of these admonitions, most persons will, at first, stop the autopoiesis because they are uncomfortable.

Once persons learn to be comfortable, the autopoiesis should last 45-60 minutes, although it may last more than two hours.

I recommend that those who do research in autopoiesis and/or creative transformation record the quantum octologue during the autopoiesis. You will find that almost all successful participants say the same things during the first few sessions. Neither you nor I should say what these things are so as not to bias the results. Do your best to avoid suggestion in the process.

If you follow the selection process recommended in this Appendix and the experimental procedure outlined, you shall find that only those who can not make a sincere commitment to play the Game of Life shall fail. Everyone else shall succeed the first time. Among those that succeed, approximately 75% will have what they subjectively regard as an extremely worthwhile experience the first time they try the autopoiesis. The other 25% will have a neutral experience, but will want to try again. Almost 100% of the persons who succeed the first time will report, and you can verify the following:

(a) They become increasingly objectively more creative in their personal life as they repeat the autopoiesis every two to four weeks.
(b) They become increasingly more loving toward everyone and are objectively more effective in their interpersonal interactions.
(c) They have a dramatic decrease in their subjective fear and an objective decrease in their destructive behavior.
(d) Synchronicity increases in their life and increasingly more meaningful coincidences occur which make them more objectively creative.

The long-term effects are even more dramatic, although they require persistence and patience to achieve. I will not bias your results by saying what they are. If you do these experiments in good faith with an open, skeptical mind, you will soon know what they are. The process of creative transformation requires absolutely no "faith." Be as skeptical as you wish, so long as you are not certain that the process will not work. It only requires a sincere commitment to play the Game of Life to be guaranteed success in Creative Transformation.

19. When everyone has finished autopoiesis, gather everyone together one more time and ask the participants to share their experiences. Let those who wish it exchange addresses and phone numbers and continue creative transformation on their own. Invite all participants who wish it to join you in your octet or network, but make no other commitments to them at this time. Just say goodbye for the time being.

20. Next, the participants gather their things, make sure that they have all fulfilled their housekeeping obligations, and leave. Open yourself to those who wish to remain a while longer and talk with you. The next steps will become obvious to you once you do this experiment a few times.

Glossary

Aberrant Descriptive term applied to actions or things which deviate from what is considered normal and proper by the person(s) applying the term.

Amoral Only sub-human beings are amoral. To be amoral is to be unaware of the Game of Life at both the unconscious and conscious levels. Amoral beings are only pieces, never players, in the Game of Life. An amoral species is doomed to extinction. Only a moral species can continue to evolve without mutating physically.

Art A process which uses entertainment to expand creativity. This is usually done symbolically through unconscious stimulation of the mind. Art is similar in its social function to dreaming. Art reflects the creativity of a culture.

Asymptotically A word which refers to a process by which something is always getting closer to something else but never reaches it.

Autopoiesis The process within living cells by which protein creates DNA while DNA creates proteins. Neither can create itself by itself, but together both can create each other. This term was first coined by Francisco J. Varela and Humberto R. Maturana in 1974. Its meaning is broadened in the theory of Creative Transformation to include any creative exchange of complementary information such that a new epiphenomenon arises.

Bacteria The set of all free-living cells without a well-defined nucleus; the DNA may be diffused throughout the cytoplasm. (Monera)

Behavior Divided into subjective and objective behavior. Subjective behavior refers to actions observable only by the person behaving, e.g., thinking. Objective behavior refers to actions observable by more than one person, e.g., speaking.

Behaviorism A system of psychology and psychotherapy which states that all models of behavior must be based *entirely* on measurable objective behavior. Behaviorism has been effective in predicting and controlling simple animal and human behavior. It has not been shown to increase creativity in any way.

Belief A belief is a state of mind in which someone imagines something to be true. In science there are no beliefs but only probabilities of certain relationships holding under certain circumstances. In science there is never certainty. Only ideologies propound certainties about nature.

Biomass The total mass of all living creatures which inhabit a specific environment at any given instant. The percentage of the total biomass taken up by a given species is a mea-

sure of the biological success of that species in that environment at that instant.

Biosphere The envelope of life which surrounds the Earth. It includes all life forms on water, land, or in the air. According to Teilhard de Chardin the biosphere is the precursor to the Noösphere. The Biosphere includes the biomass of the Earth.

Bureaucracy An organization which destroys truth by seeking to destroy all means of detecting its errors and shortcomings. A bureaucracy operates without utilizing feedback and self-correction. Whatever its *de jure* purposes, a bureaucracy's *de facto* purpose is limited to enhancing the security of its members. Bureaucracies control their members by convincing them that they are uncreative and can only survive as parasites. A bureaucracy is always threatened by anyone's creativity. All bureaucracies ultimately wish to destroy all creativity and live in a totally classical world. The first step is to force everyone to ask permission of the bureaucracy in order to do anything creative in the bureaucracy's *de jure* area of authority and responsibility.

Certainty A state of mind in which no doubt exists about some cause-and-effect relationships. It is unethical to be certain about anything except the existence of our own thoughts and perceptions, which are not cause-and-effect relationships. The need for certainty may be the fatal flaw in human nature. Through Creative Transformation, humanity can learn to cope with the insecurity of uncertainty. One cannot learn when one is certain.

Chaos Total disorder. Where nothing has meaning or purpose and all is random. The lowest level of awareness. A patternless nothingness. It is postulated that the Quantum Field always brings order out of chaos in our universe.

Child A child is a transitory being bridging the gap between amorality and morality. Children are always ethical for at least a while. When children become unethical, they may become immoral adults. Immoral adults can only have power by controlling children. Children are pliable and can just as easily become moral or immoral adults. An unethical society turns most of its children into immoral adults. An immoral society turns all of its children into immoral adults. The converse is true for moral and ethical societies. Man has been a child for most of his existence. *Homo sapiens* seems to be the first species of man with the capacity to produce moral adults. "Child" as here used is an ethical descriptor and not a chronological indicator. "Young child" is used to describe "children" in the more conventional sense. Young children are almost always "children" in the ethical sense. The converse is not necessarily true.

Civilization A civilized people may be defined as a group of persons tied together by a common ethical code who systematically predict and control their collective ability to predict and control. The essential difference between civilized and uncivilized people is that among the uncivilized persons there is no systematic group effort to create machines for the benefit of the group as a whole which require several persons to operate and which may not be used for several months or even several years after construction is begun on them. It is this notion of long-range planning and concern for the creativity of future generations which distinguishes the civilized person from the barbarian, who typically never has any vision beyond tomorrow, or the savage who lives entirely in the present. The longer into the future the planning

is projected, the more civilized is the society. Therefore, a civilization never comes into being or survives unless it is guided by a cooperative group of persons who have a vision of and concern for the generations yet unborn. The vision of the future is always tied to the ethical code.

Communism A socialist system with a rigid, unscientific, bureaucratic basis derived from Marxist and Leninist ideology. It propounds the materialistic ethic. The *de facto* ethic is to maximize the power of the Communist Party and its leaders. *Glasnost* and *Perestroika* are tolerated by some of the communist bureaucracies only because it is argued by some that these reforms are essential to reverse the obvious decay in communist society. Marx was merely a well-intentioned propounder of a false ideology. Lenin was the implementer of the most evil tyranny in history.

Connectors Channels through which Information flows from one component of intelligence to another. In our bodies Connectors are represented by nerves.

Conscience Our inner sense of right and wrong—truth and falsehood—which unconsciously guides us through our intuition. Our conscience is apparently always correct, and never fools us. We apparently only fool ourselves by substituting fear for conscience, and equating the two. Our conscience is produced by the interaction of our brain with the infinite-enfolded truth of quantum reality.

Conscious Refers to that state of mind in which we can predict and control our own thoughts and perceptions. The conscious mind is the set of all our predictable and controllable thoughts and perceptions.

Conservative Refers to any attitude which is intolerant of innovation. This characteristic exists on a continuum with adamant opposition to any innovation at one extreme and complete tolerance for any innovation at the other. (See **Liberal**)

Control The deliberate causal formation of a predicted set of events. Control is essential to intelligence. Without control an entity is deprived of feedback and becomes incapable of correct prediction. Control is ethically neutral. It may be used creatively or destructively.

Cosmic Force The "cosmic force" is a collective term for the joint operation of all natural laws. The cosmic force has two major components—evolution and entropy. All is an effect of the cosmic force.

Cosmic Moral Society The Moral Society which results from the joining of two or more distinct Moral Societies with independent origins on different planets.

Creation The deliberate organization of energy, matter, life and/or mind into new patterns which increase intelligence. The patterns may only be new to the creator; they are not necessarily original. Creation is the joint result of intelligence and ethics. All ethical persons are to some degree creative. Moral persons are extremely creative; they are the ones who create new, coherent models of the universe and engender new societies. Immoral persons can never create; they only destroy.

Creativity The ability to organize the total environment—physical, biological and psychosocial—into new patterns which increase truth for at least one person, while not decreasing truth for any person. Creativity is a direct function of intelligence and ethics:

$$C = IE$$

where:

C = Creativity in quanta of new knowledge generated per unit time. It ranges from infinity to negative infinity.

I = Intelligence in quanta of old knowledge controlled per unit

time. It ranges from zero to infinity.

E = Ethics, a dimensionless quantity between -1 and $+1$ representing the fraction of our total energy spent decreasing truth (negative) or increasing truth (positive).

This equation is an approximation.

Critical Mass The point at which the density and quantity of a substance is such that completely new effects take place. For example, a critical mass of ethical persons (4 men & 4 women) is necessary to create an Ethical State. A critical mass of moral persons is sufficient to engender a Moral Society and make evolution irreversible.

Culture The total sum of extra-genetic information posessed by a people or by a civilization.

Cyborg (Cybernetic Organism) An entity which incorporates a machine as an integral part of its structure. May be pictured as a robot with a person inside it who completely controls the robot and uses it to amplify and simulate his individual powers. Humanity is becoming a Cyborg.

Death The state of maximum entropy for life. It is the state where the intelligence produced by life sinks to the level of matter. The preponderance of scientific evidence indicates that for all life forms death represents the total extinction of the ego. More generally "death" is a decomposition of a system into its components, e.g., a molecule into atoms, an atom into elementary particles, or a society into disorganized individuals. Death is essential to evolution by natural selection.

Decency Persons are decent when they will not deliberately enhance their welfare at the expense of another person's welfare. Decent persons are ethical if and only if they interpret "welfare" as synonymous with creativity. Decent persons are unethical if and only if they interpret welfare as synonymous with happiness. Decent unethical persons increase entropy by destroying negative feedback for themselves and others. Indecent persons are always unethical, and increase entropy by destroying other persons' creativity as well as their own as a means of increasing their own happiness.

Decline (Decay) A process by which the total collective creativity continuously decreases, while the entropy increases until the capacity to evolve disappears.

Democracy A system of representative government in which the representatives are chosen by majorities in free elections. Elections are assumed to be free if and only if all persons are guaranteed personal freedom. It is assumed, ideologically, that freedom is a necessary and sufficient condition for progress. All democracies eventually are controlled by unethical demogogues who tell the masses the lies they wish to hear.

Democratic Ethic The greatest good is that which makes for the greatest freedom for the greatest number; the rights of large majorities are absolute over small minorities.

DNA (Deoxyribonucleic acid) A complex polymeric organic molecule in the form of a double helix. DNA molecules carry all the information for structuring all known life forns. All the information for structuring the body of a human being is contined in the DNA molecules of a single cell. The DNA molecules are the blueprint from which life can be structured. DNA is built on templates of RNA, although information transfer appears to normally go the other way.

Destruction To decrease creativity by decreasing truth. This may be done by generating false information or degrading true information. Unethi-

cal persons destroy more than they create. Children may create or destroy. The more intelligent an unethical person is, the greater will be his capacity to destroy.

Destructiveness The disorganization of the total environment into patterns which decrease the ability of any or all ethical persons to predict and control their total environment—physical, biological and psychosocial. Negative creativity. The decrease in ethics, truth, or creativity for any person.

Direct Perception The clear realization of a pattern in nature, analogous to the perception of our own thoughts. Illusions of certainty are sometimes mistaken for Direct Perception. Direct Perception is valid only insofar as it enables us to predict and control in the objective world.

Disease Any condition of an organism acquired through heredity or environment which decreases its intelligence, i.e., ability to predict its total environment—physical, biological and/or psychosocial.

Ecosphere The region around a star in which it is possible for a planet with liquid water to exist. The sun's ecosphere extends from just inside the orbit of Earth to just outside the orbit of Mars.

Education Any process which increases the creativity of those exposed to it, or any process which increases any organism's ability to predict and control by increasing or altering the information content of the organism without damaging ethics. In modern society, many alleged forms of "education" are destructive because they destroy ethics, although they may increase intelligence.

Effectors That component of intelligence which generates events in the total environment. Within the body, Effectors are represented by our bones, muscles and connective tissues in general. Effectors directly alter the environment.

Ego That part of us that takes its identity from our memory and experience. The ego is driven by fear and the desire to be happy—as opposed to the soul, which is driven by love and the desire to maximize creativity. The ego dies with our body; the soul lives on in the creativity we engender in others. (See **Soul**)

Emotion A pre-programmed pattern of behavior which is primarily instinctual, i.e., genetic, in origin. All emotions, except love, are becoming increasingly destructive, i.e., they serve only to decrease creativity instead of to expand it. All emotions are useful for survival in a primitive, Darwinian environment when there is little knowledge at hand. Love is always a constructive emotion because it catalyzes the creative transfer of information, thereby inducing a higher order autopoiesis. When we substitute fear for creative action we become ever less creative. All emotions are combinations and permutations of love and fear.

Entertainment Any process which increases the happiness of some persons without necessarily increasing the creativity of any person. Entertainment which increases creativity is called "Art."

Entropy A condition of chaos as well as a force which increases the chaos in the universe. The entropic force drives mind toward matter and matter toward chaotic energy. Entropy manifests itself in mind by decreased intelligence and/or ethics. In humanity, entropy is measured by the amount of illusionary information and by the effectiveness of the mechanisms for limiting feedback. Entropy feeds upon itself and is negatively correlated with creativity. Creativity is sometimes called "negentropy."

Epiphenomenon A phenomenon which arises as a not-readily predictable effect of many complex underlying phenomena. An epiphenomenon can in turn affect the effects which caused it. For example, life is an epiphenomenon of the infinite tangled hierarchy of protein creating DNA as DNA creates protein. Life in turn affects both protein and DNA. Similarly, consciousness is an epiphenomenon of the infinite tangled hierarchy of the brain modifying its field effect, the mind, as the mind modifies the brain and both becoming increasingly receptive to the infinite, true information in the implicate order through the potential of the quantum field.

Ethical (Good) Behavior is ethical if and only if it is a strategy in the Game of Life. Therefore, only behavior which increases creativity is ethical. Persons are ethical if and only if they are increasing creativity. In other words, persons are ethical if, and only if, they play the Game of Life more often than they play the Game of Pleasure. To be ethical is to create. Ethical behavior is, therefore, synonymous with creativity; it is the highest form of intelligence. Only humanity has clearly and systematically exhibited ethical behavior, because only humanity has increased creativity as a species. Almost all other species only increase intelligence by mutating into new species. Virtually all human beings are ethical during their early childhood. Persons only become unethical by being subjected to the pressures of an unethical society, which manipulates and controls them through fear, and random entropy. The other higher primates, cetaceans, and elephants also have ethical elements in their behavior but they do not seem to systematically create.

Ethical Intelligence The ability to predict and control the total environment creatively.

Ethical Principles Logically derived principles that follow directly from the evolutionary ethic. ("We must do our best to maximize creativity.") The evolutionary ethic cannot be in logical error since it is an ultimate goal, not a means to any end. The derived ethical principles may be in logical error; we should follow them only if they lead to no ethical contradictions according to the dictates of our conscience and objective evidence. These principles lead to other intuitively proper maxims of conduct such as the Ten Commandments and other biblical imperatives, Buddha's Eight-Fold Way, the Sermon on the Mount, and the American Bill of Rights. The eight ethical principles follow: 1. Only actions or persons which increase creativity are ethical. 2. Any action or person which decreases anyone's creativity is unethical. 3. Unethical means can never achieve ethical ends. 4. Means which are not ends are never ethical. 5. It is unethical to tolerate destructiveness. 6. It is unethical to be certain. 7. It is ethical to doubt. 8. Inaction is unethical.

Ethics Rules of optimal behavior. It may be shown logically that behavior is optimal if and only if it is a strategy in the Game of Life. The rules of the Game of Life are, therefore, the Ethics of Life and are the only true ethics. All other forms of behavior are unethical or trivial. Ethics occurs in life when an entity has intelligence about its own intelligence, and it can predict and control its own ability to predict and control. Ethics are the highest form of intelligence. Morality is the highest form of ethics. (See Good)

Evil (Unethical) Refers to any action or thing which decreases creativity.

Evolution (See Entropy) A condition of intelligence as well as a force

which pulls everything in the universe toward greater intelligence and complexity. Evolution is the opposite of entropy. The evolutionary force pulls matter toward mind and mind toward ever greater intelligence. A level of evolution is measured by the degree of intelligence. The greater the intelligence of a being, the higher it is on the evolutionary scale. Evolution is a law of nature and not a coherent plan. Evolution has a direction of ever greater intelligence and certain properties; however, it is basically a random process because it always coexists with entropy. The higher a being is on the evolutionary scale, the less subject it is to entropy, if it behaves ethically. Therefore, evolution catalyzes and derandomizes itself through intellectual development in general and ethics in particular.

Evolutionary Ethic "We must do our best to maximize creativity."

Evolutionary Pressure Refers to the propensity of natural selection to favor some mutations over others because of the current environmental opportunities that exist for those mutations. This has nothing to do with an outside directed force, conscious or otherwise. "Evolutionary Opportunities" would be a synonym. The biological response to environmental opportunities which favor certain types of mutations. The "pressure" pulls the species toward these opportunities. It does not push them forward. The pressure can be seen as a pull from the future.

Falsehood Information that decreases our ability to predict and/or control any part of the total environment when we believe it.

Family A group of beings tied together by mutual love. (See **Immediate and Extended Family.**)

Fear The belief we cannot create. Fear originates as an emotional pre-programming of the R-complex, that predisposes us to fight or flee in the face of danger. (See **Emotion.**)

Feedback Refers to the perception of the consequences of our actions. Positive feedback refers to perception of our successes, i.e., when the total environment was in fact predicted and controlled. Negative feedback refers to the perception of our mistakes, i.e., to attempts at prediction and control which failed.

Freedom (Liberty) Refers to a state in which we can do and say as we please so long as we do not in the process interfere with the right of another person to do and say as he pleases. When there is a conflict, a compromise is reached which maximizes creativity for both persons. In general, free persons can do as they please so long as they do not impose undeserved harm on others. Freedom gives us the right to destroy our own creativity, but never the right to destroy anyone else's creativity.

Game A set of rules of how to behave in order to win a specified stake. The stake may be symbolic or tangible. A game has no purpose beyond itself. All persons play games either consciously or unconsciously. Every game is either a variation on the Game of Life or a variation on the Game of Pleasure. For any given person, the same game may be a variation on the Game of Life at one time and a variation on the Game of Pleasure at another time.

Game of Life A game in which the stakes are ever-expanding creativity. The Game of Life is the pivotal point between good and evil, life and death. The Game of Life is the basis of all evolution. To play the Game of Life is to increase creativity. To deliberately play the Game of Life is to increase creativity as best we can for the rest of our life.

Game of Pleasure A game which

serves only to increase happiness, never creativity. Persons who play the Game of Pleasure are the major source of entropy for the human race. Players of the Game of Pleasure make themselves and others increasingly unethical until they become immoral. All players of the Game of Pleasure unconsciously long for death.

Generalist (See **Specialist**) A generalist is a person who is aware of the total environment—physical, biological, and psychosocial—in approximately equal degrees. Generalists have tried to learn, in approximately equal amounts, all of human knowledge. They attempt to maintain sphericity by not developing great depth in one area while still ignorant of another area. It is possible for a generalist to have more depth in all areas than a specialist has in only one area. We generalize by learning what we know least. We specialize by learning more about what we know most, increasingly ignoring what we know least.

Genotype The genetic make-up of an organism which interacts with the external environment to produce the overt phenotype.

Good (Ethical) Refers to any action or thing which increases creativity.

Great That is great which significantly expands the creativity of others. This applies to art, science, or persons. Greatness implies extreme ly important social morality.

Guru A teacher whom we revere and trust to the point of surrendering our conscience to him or her, thereby letting the guru determine for us what is right or wrong. This is destructive for both the guru and the disciple. We should always follow the dictates of our own conscience and not abdicate our conscience to anyone, nor allow anyone to abdicate their conscience to us.

Happiness The state of mind which results from being in the process of fulfilling our desires. The intensity of happiness is directly proportional to the strength of our desires and the rate at which we fulfill them. In the absence of desire there is neither happiness nor unhappiness; the more ethical a person is, the more that person's happiness comes from maximizing creativity. Happiness and creativity are not mutually exclusive; neither are they synonymous.

Health The physical and mental condition conducive to predicting and controlling the total environment. Whatever diminishes our ability to predict and control the total environment diminishes our health. When this occurs through physiological change, such as a broken leg, then it is our physical health that is diminished. When this occurs through a change in the information content of mind, then it is mental health that has been diminished and we say that the person is neurotic. When there is a combination of deleterious physiological and information changes in the nervous system, the person may become psychotic. The best objective indicator of health is creativity. Unethical persons are neither healthy nor creative.

Hedonism A sense of values which gives the highest value to pleasure and happiness. Hedonism represents the pursuit of happiness to the exclusion of creativity. A hedonist seeks to maximize happiness above all else. The pursuit of happiness without creativity leads only to death.

Heritability A statistical notion based on the theory of analysis of variance. It is expressed by a number between zero and one. A heritability of zero indicates that the phenotypic differences between statistically differentiable groups are not due to genotypic differences, but are solely determined by the

environment of the organism. A heritability of one indicates that the environmental differences between the groups in question produce no significant differences with respect to a specified trait; all differences concerning the trait are assumed to be due to genetic differences.

Homo moralensis Moral Man. The latest development in *Homo sapiens* represented by persons who deliberately play the Game of Life. The successor to Teilhard de Chardin's *Homo progressivus*. All *Homo moralensis* are in an Ethical State.

Homo progressivus Progressive man. A term used by Teilhard de Chardin to connote persons who perceive and value human progress and have faith in mankind's future. The successor to *Homo sapiens*. Persons capable of entering the Ethical State.

Homo sapiens The species of man which has been dominant for about 50,000 years. Cro-Magnon was a *Homo sapiens*; Neanderthal was not, although they could probably interbreed, as can lions and tigers.

Ideology An ideology is an interdependent set of ideological beliefs. An ideological belief is a belief in a cause and effect relationship which is not based on scientific evidence. All superstitions are ideological beliefs. All religions are ideologies. Marxism and most of what is called "social science" are ideologies. Ideologies are not necessarily wrong, merely unscientific.

Ignorance A lack of important true information within the nervous system of an organism.

Illusionary Information Refers to a belief which has no basis in reality. It can occur by imagining a model of cause and effect relationships which cannot be substantiated scientifically. Most illusionary information results from accepting the imagined model of someone else as true when it is in fact false. Skepticism is the best defense against illusionary information. Systematic, creative skepticism is the basis of the scientific method.

Imagination That component of intelligence which generates Information independently of the Sensors. Imagined events are used to complete the pattern of sensed events so that there are no inconsistencies. The Effectors test the validity of the completed pattern by generating new events until all the sensed events are consistent. This is how creativity grows. Imagination has never been localized as have other components of intelligence. It seems to be associated with the neocortex in general and the frontal lobes in particular. The more ethical a person is, the more imaginative he seems to be. It may be that Imagination is produced in part by the moral field of the Cosmic Moral Society and that receptivity to this field depends on ethics. The moral field and the quantum field may be synonymous.

Immediate (Nuclear) Family A family limited to our parents, children, spouse, and siblings. (See **Family**)

Immoral A person is immoral if and only if he deliberately declines the challenge of the Game of Life and consciously chooses to play the Game of Pleasure. Immoral persons only play the Game of Pleasure. Persons become immoral by becoming increasingly unethical until all their actions are strategies in the Game of Pleasure. Immoral persons never play the Game of Life again; they have irreversible entropy. Persons are made immoral by an unethical society. Only highly intelligent persons can become immoral. Most unethical persons are children, not immoral adults.

Immoral Community The Immoral Community is that group of persons who seek power without creativity. When these persons are decent,

they seek to make others happy. When they are indecent, they seek only to make themselves happy. The Immoral community is represented by the "Establishment" in every country. the Immoral Community serves only to increase the total entropy of the human race.

Important Refers to any activity or thing which significantly affects creativity either positively or negatively. "Unimportant" is synonymous with "trivial."

Industry A collective term for any organization which serves to produce any goods and services other than entertainment and education.

Information The symbolic representation of events and their relationships. Information is an essential component in the structure of intelligence. An entity devoid of all Information would have no intelligence. All the Information in our bodies, except instinct, is produced by the Sensors or by the Imagination.

Innovation The production of any new information or behavior.If it is creative it is an invention; if not, it is a trivial or deleterious innovation. Humanity has the capacity to produce more creative than non-creative innovations. All other existing species seem to produce creative and non-creative innovations equally.

Intelligence The ability to predict and control the total environment—physical, biological, and psychosocial. Intelligence is a structure with discrete components, namely, Will, Memory, Logic, Imagination, Sensors, Effectors, Connectors, and Information. Each of the components is essential to Intelligence. All the components, except for Information, seem to have a largely hereditary basis. (See pages 12 to 17.)

Invention The creation of a new machine or new behavior which decreases the entropy of the biosphere. A new machine or behavior which increases entropy is called a deleterious innovation, not an invention. Innovations must increase the net creativity of the universe to be true. Not all innovation is creative.

Investigator Any person who systematically seeks new knowledge on any subject(s).

Joy A condition of extreme happiness. Joy is happiness without anxiety; it is a happiness which we have no fear of ever losing. It seems that only the deliberate expansion of creativity for ourselves and others produces joy.

Knowledge A critical mass of true information which enables us to predict and control something. Our knowledge is a function of our innate intelligence and our environment. The geometry of our knowledge (i.e., a spherical or an ellipsoidal surface) is dependent on ethics; the depth (volume of the ellipsoid) depends on our intelligence. True information becomes knowledge only when it is a component of intelligence. Knowledge comes from creativity.

Leftist Refers to a belief that behavior is determined primarily by environment and not heredity. This belief exists on a continuum. The extreme leftist believes that heredity plays no role in shaping behavior and that environment is all important. The extreme rightist believes the opposite. (See **Rightist**)

Liberal Refers to any attitude which is tolerant of innovation. This characteristic exists on a continuum with the extreme conservative—intolerant of all innovations—at one extreme and the extreme liberal—tolerant of all innovations—at the other. (See **Conservative**)

Liberty (See **Freedom**)

Life That effect of matter which produces an intelligence of non-self and causes intelligence to expand

and grow until it produces intelligence about intelligence. At this time mind begins to develop rapidly until it ceases to be an effect of life and becomes an effect of itself. Living creatures all have the capacity to make choices. The more intelligent they are the more choices they have. Matter cannot make choices. Its behavior is predetermined. (See **Mind**)

Logic That component of intelligence which determines when different quanta of information and/or knowledge are inconsistent. Logic is a filter which tells the Will which events are inconsistent in order that new events may be generated until all events are consistent. All events are consistent if and only if a person is infinitely intelligent. Therefore, all events are never consistent. A person who sees inconsistent events as consistent is either psychotic, ideological, or both. Logic appears to be a function of parts of the cortex.

Love Refers to a type of behavior as well as to an emotion. As an emotion it is a preprogrammed state of mind which predisposes us to behave in such a way as to enhance the welfare of another even at the cost of our own welfare. When welfare is seen as synonymous with happiness, then the love is perverse and unethical. When welfare is seen as synonymous with creativity, then love is natural and ethical. Ethical love is the only antidote to fear. No one can ever lose anything of value by loving or being loved ethically. Love is the desire to increase, and the act of increasing, the creativity of another.

Machine A manufactured device which converts one form of energy into another. Language, clothing, computers, houses, tools, and organizations are examples of machines. The machine is an essential component in human evolution. Since the advent of *Homo sapiens* human evolution has depended almost entirely on the development of ever better machines and the increase in ethics.

Materialistic Ethic "That which makes for the greatest material security for the greatest number is the greatest good." From each according to his ability, to each according to his need.

Measure Zero A concept from set theory which says, very loosely speaking, that a point set has measure zero if there exists a finite or a countably infinite set of open or closed intervals of length l or smaller that cover all the points in the set, and the total length L of the sum of these intervals, $L=\sum_{i=1}^{N} l_i$, $l_i<l$ for all l_i, can be made arbitrarily small. For example, if $l=1/2$ and $L=\sum_{i=1}^{N}(1/2)^i=1-(1/2)^N$ for all N, and if N is an integer, then as N goes to infinity, the sum $1-(1/2)^N$ goes to 1. Therefore using only elementary algebra, we can show that for any $X>0$ and $N=$ any integer larger than 0, we have $L=\sum_{i=1}^{N}(1/(1+X))^i=(1/X)[1-(1/(1+X))^N]$, $1/X-(1/X)(1/(1+X))^N \rightarrow 1/X$ as N approaches infinity. In the previous example, $X=1$. Therefore, all finite or countably infinite subsets have measure zero because we can multiply the preceding sum by any arbitrarily small positive number to get a sum of intervals that is arbitrarily small, if $l=1/(1+X)$. There are also non-countably infinite sets of measure zero, such as the mathematically well-known *Cantor Set*.

Trivia is a set of measure zero because in the long run almost all acts either increase or decrease creativity. An act which never decreases anyone's knowledge, but imparts zero knowledge forever, will decrease creativity by wasting the energy and time of those commiting

the act. Therefore, trivia is at best a set of measure zero in the short run and an empty set in the long run.

Memory That component of intelligence which stores Information in retrievable addressable units. The address is determined in part by the nature of the Information and its relationship to other Information. In our own bodies Memory seems to be a process by which molecules are altered in our brain by sensed or imagined information, and the brain is thereby physiologically altered. It may be that memory is holographic so that all the information of the brain is stored in each brain cell. (280)

Metazoa Multicellular animals as opposed to Protozoa, which are unicellular. Sponges, insects, fish and humans are all metazoa.

Military A collective term for any organization which serves to impose the will of any authority by force.

Mind The set of all our thoughts and perceptions. Insofar as thoughts and perceptions are predictable and controllable, the mind is conscious. Insofar as thoughts and perceptions are unpredictable and uncontrollable, the mind is unconscious. We know with certainty only the existence of our own minds. We infer from the behavior of other organisms and our own behavior and mind that other organisms have minds similar to our own insofar as they behave similarly to us. From this inference we can develop a mind model of behavior which can objectively be shown to enable us to predict and control behavior. The mind model is analogous to the model of gravity. We cannot perceive directly the existence of gravity, but it is a model which enables us to predict and control. Gravity is an effect of mass as mind is an effect of the brain. Gravity affects mass just as mind affects the brain. Any mind may be an interactive effect of a living body and the Quantum Field.

Minimax Strategy A plan for minimizing our risks by obtaining the best of the worst in a game. In the Game of Life the worst is entropy, therefore, the minimax strategy is also the uniformly optimal strategy which maximizes our creativity while minimizing our entropy. In the Game of Pleasure the worst is unhappiness. The best of the worst is extinction. Death is, therefore, the minimax strategy in the Game of Pleasure. Following the rules of the Game of Life is a uniformly optimal strategy in both the Game of Life and the Game of Pleasure (see **Uniformly Optimal**). Exclusively minimax strategies lead to death and are followed only by those who are driven by fear.

Moral A type of behavior in which all actions either increase objective truth or are trivial. Persons become moral if and only if they see the maximal expansion of creativity as the only purpose of life and are indifferent to anyone's happiness, including their own. The more intelligent moral persons are, the more creative they will be. Moral persons never behave unethically again after becoming moral. Moral persons are devoid of fear. They always behave lovingly toward all persons, including their worst enemies. No human being appears to ever have been moral. We approach morality asymptotically by becoming increasingly ethical and intelligent.

Moral Community The Moral Community is that group of persons who are primarily concerned with expanding creativity. The Moral Community includes artists, scientists and technologists. A technologist is anyone concerned with producing goods and services which increase creativity. Physicians, farmers, teachers, laborers and mechanics are all examples of tech-

nologists. The Moral Community represents the true workers of the world who are exploited by the Immoral Community.

Moral Sense The genetically determined program, apparently unique to the human species, which makes humans value creativity above happiness. The Moral Sense is easily perverted into self-righteousness and intolerance by unethical persons who believe they have found ultimate, absolute truth when in fact they have only found self-deception.

Music The purest art. It is devoid of conscious meaning and operates entirely at the unconscious level to communicate the creativity of a culture by patterns of abstract sounds, which are perceived as beautiful.

Mysticism Any systematic attempt to obtain truth through direct perception independently of scientific evidence and processes. Mystical truth is always of subjective origin. When mystical insights are supported by scientific evidence, then the mystical truth becomes objective. There is no conflict between mysticism and science as long as mystical insights are not held to represent a higher reality than objective truth. It is in the nature of mysticism that its specialized adherents tend to substitute subjective truth for objective truth and in the process become practitioners of psychofraud. All the major religions and traditional ethical and psychotherapeutic systems seem to have a mystical basis. Creative Transformation uses mysticism in conjunction with science. What all mystics have in common is a belief in a higher source of moral order and greater knowledge than humanity in the universe and that humanity can communicate with the source through ethical behavior.

Nature-Nurture Problem The problem of determining whether differences between groups or individuals are due to heredity (nature) or environment (nurture).

Neuroses Learned patterns of behavior which decrease a person's ability to predict and control his total environment. Uncontrollable emotionalism is not necessarily neurotic unless it has been caused by some learned experience; e.g., persons who are filled with hate for some particular ethnic group are neurotic because it is necessary to learn to hate a whole ethnic group, and this behavior decreases creative intelligence. Because neurotic behavior is learned behavior, it is susceptible to modification by all types of psychofraud, as well as Creative Transformation and other learning experiences.

Noöspace The abstract space of mind where each dimension represents an orthogonal area of knowledge. For convenience, noospace may be seen in three dimensions—the physical, biological, and psychosocial. In reality, noospace probably has infinitely many orthogonal dimensions. Only by relating each dimension of noospace to all other dimensions can creativity be maximized. Knowledge can be specialized, but creativity is holistic.

Noösphere (no″-os′-feʌr) n. [Gr. *noos,* mind, and *sphaira*, a body whose surface always has all its points equidistant from a single point], the envelope of collective human mind which surrounds the Earth. A word first used by Pierre Teilhard de Chardin to describe some aspects of the Moral Society. (See **Biosphere**)

Nucleons Protons and neutrons. All atoms have a nucleus of at least one proton with zero or more neutrons.

Optimal Refers to the extremal (maximum or minimum) of an effect in a desired direction. Something is optimal when it is the best there is and there is nothing better. Opti-

mality is not necessarily a unique property. In a game there may be many optimal strategies. When persons behave optimally it means that they have done the best they could. It does not mean that someone else might not have done better.

Organization A group of persons tied together by a set of commonly accepted objectives and rules. All organizations have the propensity for being turned into bureaucracies, if they are deprived of feedback. All bureaucracies are organizations, but not all organizations are bureaucracies. A family is an organization tied together by mutual love. Organizations are turned into bureaucracies solely through fear.

Orthogonal At right angles. When events or actions are orthogonal, then each can occur without necessarily affecting the other. However, orthogonal events are not necessarily independent.

Parasite (parasitical human being) Any entity which produces pollution and consumes resources without in any way contributing to anyone's creativity. In general a parasite has higher entropy than its ancestors and can survive only at the expense of an entity that has lower entropy.

Perception That property of mind which integrates sensed information into a meaningful whole so that knowledge results.

Personal Morality Refers to the deliberate desire to increase one's own personal creativity. Personal morality must coexist with social morality or it will atrophy. Without social morality personal morality may become perverted into a desire solely for personal power. All ethical persons have both components of morality, but not necessarily in equal amounts. (See **Social Morality**)

Personal Power Control over the environment used solely as a means of producing personal security. Destructive control over other persons.

Personality A subset of Will which determines what will be predicted and controlled and the resolve to accomplish its ends.

Perverse Refers to any action or person which seeks to increase happiness in such a way that creativity is not increased. A pervert is any person who systematically increases his own happiness without increasing anyone's creativity, including his own.

Phenotype The external appearance of an organism in terms of its morphology and overt behavior. (See **Genotype**)

Phylum A group of life forms characterized by unique properties which make them distinct from all other life forms. For example, arthropods are characterized by jointed legs and a chitinous exoskelton; chordates by the notochord; and ethical beings, including humans, by intelligence about their own intelligence.

Power The ability to control the environment, not necessarily creatively.

Predict and Control Refers to the essential property of intelligent organisms by which events are foreseen and made to comply with the organism's needs and desires. The ability to predict cannot exist independently of the ability to control and vice-versa. Although humanity could predict astronomical events long before it could control them (as in the case of artificial satellites), it could not have predicted any astronomical events if it could not have controlled its observational procedures by controlling its own biological Sensors (eyes, ears, etc.) and the creation of amplifiers of its Sensors, such as clocks, calendars and telescopes. Any event which is controlled is by definition predicted. Therefore, control is a higher prop-

erty of intelligence than prediction, although each property is essential to the other.

Prediction Imagining an event correctly before it is directly perceived. Prediction is essential to creativity. Without the ability to predict an entity could not see the patterns which tie its perceptions together; it would have neither a past nor a future but would exist only in the present in a state of continuous destruction.

Probability Refers to the degree of confidence that a person has that a cause and effect relationship is true. Zero probability implies that the person is certain that the relationship is false. A probability of one implies that the person is certain that the relationship is true. Ethical persons always place a probability greater than zero but less than one on the validity of all cause- and-effect relationships in nature outside of the existence of their own thoughts and perceptions, which are not cause-and-effect relationships.

Progress The process of ever-expanding creativity within the universe. The progress of the human race is indicated by humanity's increasing ability to predict and control the total environment. This progress is least evident in the psychosocial environment, but even here it occurs. Only immorality can stop human progress.

Psychofraud An ideology about human behavior. Any model which purports to predict and control human behavior and cannot be scientifically verified is psychofraud. Examples of psychofraud are found in religions, political ideologies, and forms of psychotherapy.

Psychosis Compulsive destructive behavior. An extreme form of neurosis which involves organic factors. These predispose the psychotic to acquire information which grossly distorts reality. Unlike neuroses, psychoses cannot be cured unless basic organic factors have also been corrected. Some forms of psychotic behavior are at least partially corrected with vitamins and drugs.

Psychotherapy A process for replacing false information, which decreases a person's ability to predict and control his total environment, with true information which increases his ability to predict and control his total environment. Psychotherapy is a special type of education; it does not necessarily include the use of drugs or surgery, although these techniques can also change behavior and possibly even increase creativity. The best criterion for the success of psychotherapy is an increase in the net creativity of the person. Most of the treatments called psychotherapy seem to consist mainly of psychofraud.

Programming The encoding of information into a system. Human beings are totally programmed by their heredity, their environment, and their choices.

Quantum Field An information-carrying field which permeates the universe and follows the patterns of Schroedinger's equation. The field modulates the transfer of information between our universe and the implicate order. The field is "nonlocal" and operates outside of our time and space. The receptivity of any object to the Quantum Field is proportional to its degree of evolution. The more generalized, intelligent, and ethical the object, the more information it will integrate through the Quantum Field. Evolution is a process for producing ever more intelligent quantum objects that increasingly derandomize the quantum field.

Quantum Object An object whose mass is sufficiently small that it will be significantly affected by the quantum field. Larger objects can

only be affected by the quantum field if a critical mass of the smaller objects constituting the larger objects have coherence between them, e.g., lasers, superconductors, microchips, the human brain, and an autopoietic octet. The more evolved a massive quantum object with internal coherence, the more creatively it integrates information from the quantum field.

Quantum Reality A reality which exists outside of our time and space, and is linked to it through our consciousness. Quantum Reality has within it infinite, enfolded truth (the implicate order), which, through our consciousness and in other ways, affects the reality of our own time and space (the explicate order). See the work of David Bohm.

Racism A belief that the future behavior of a person can be inferred from the *a priori* expected behavioral characteristics of the racial group to which the person belongs. Racism neglects to allow for widespread individual differences within races. Science indicates that there is a wide overlap in the behavior of all races; therefore, racism is unethical.

Random Refers to a process whose outcome cannot be predicted with certainty. Any process of which we have incomplete information is random. Nature can only be exactly predicted when we possess all knowledge, i.e., when we are totally aware of everything. For this reason, nature will always seem random to any finite being. However, the accuracy, precision and extent of our predictions and control can increase asymptotically, albeit not smoothly, toward perfection within quantum limits. The randomness is within ourselves, not necessarily within the external universe. The cosmic force will always seem random to any finite being because entropy and evolution coexist in infinite extension and we can never have complete knowledge of either process. The randomness of the quantum world is due to hidden variables, which are hidden because of our own fear and lack of ethics. Only morality can surmount the uncertainty principle, by liberating our imagination and opening our mind to the infinite truth of the implicate order. The uncertainty principle is part of the cosmic quarantine.

Rational Any action or thing which is logically self-consistent and does not involve internal contradictions. In the real world things are only relatively rational, since almost every model and person has some internal contradictions, although they may not be apparent. This results mainly from a lack of scientific knowledge, not necessarily poor logic. Newton's model of the universe was more rational than that of Aristotle but less rational than that of Einstein, although all these models were highly rational in relationship to the more popular models of their day. Only moral, scientific mystics can be totally rational.

Real Time A term from process control technology by which information is obtained, processed and acted upon almost as soon as it is available, i.e. almost simultaneously. As the delay times in obtaining essential information lengthen, the process ceases to be "real time." A synonym for "real time" would be "almost simultaneously."

Reality That which we can (1) predict and control or (2) know that we can neither predict nor control. Our thoughts and perceptions are always real but not the models we create about what causes our thoughts and perceptions. Only that which is true is real. Only models which enable us to predict and control are true. Reality is anything that increases our creativity when we believe it or

decreases our creativity when we do not believe it.

Relevant Anything which expands creativity is relevant. That which best serves to integrate and expand the totality of knowledge is the most relevant. Relevance implies something that is both important and ethical.

Religion Any ideology which (1) seeks to explain the basic cause and purposes of the universe and (2) stresses means for predicting and controlling our thoughts and perceptions beyond the limits of our lives. In religion, the most important truths are assumed to be known, and new truths are accepted only insofar as they support the basic assumptions. Religions are an ethical attempt to create a coherent model of the universe and humanity's relationship to it. Religions become evil only when they are closed systems which do not accept information contradicting the basic ideology. It is the Moral Sense which continuously causes us to seek the one true religion. It is the immoral sense (fear) which makes us believe we have found it.

Rightist Refers to a belief that human behavior is determined more by heredity than by environment. The characteristic exists on a continuum with the extreme rightist believing that all behavior is determined entirely by heredity and that environment has no effect whatsoever on behavior. The extreme leftist believes that all different behavior is determined entirely by environment. (See **Leftist, Liberal, Conservative**)

Robot A machine which is self-directed, and can predict and control its environment, but has no creativity or capacity for ethical choice.

RNA (ribonucleic acid) RNA is a constituent of all living cells and viruses. It has the capacity to store information. DNA can be built on templates of RNA. RNA can carry information between DNA molecules.

Sanity That property of mind which permits it to cope rationally with problems and to see things as they objectively exist.

Science A method for increasing truth which is based on the principle that all hypotheses and theories are to be held in doubt until proven tentatively true by controlled experimentation. Hypotheses and theories are held to be tenatively true only so long as they make correct predictions. Those hypotheses and theories which make the most accurate and consistently correct predictions are the "truest." In science only that which works is true. Truth is always tentative and incomplete. The main function of science is to help us distinguish between true and false ideas.

Scientific Generalist (See **Generalist**)

Scientific Illiterate A person who has little or no scientific knowledge, i.e., knowledge obtained through the scientific method. In general, a person who has no sytematic knowledge of mathematics, physical science or biology is a scientific illiterate. In general, scientific illiterates are victims and practitioners of psychofraud. Specialized scientists tend to succumb to ideology in those parts of the environment about which they have little or no scientific knowledge. Since there is so little scientific knowledge of the psychosocial environment, this is the major area of ideology and psychofraud. All persons tend to create the illusion that they can predict and control their total environment. Therefore they fill their minds with psychofraud and ideology when they are not scientific generalists. Scientifically illiterate mystics as well as scientists who do not apply scientific method to their mystical

beliefs are filled with self-delusion.

Security A state of mind in which persons believe they have or can readily obtain all they need and have no fear of losing what they already have. External security as well as external insecurity are always illusions. The only true security comes from within through creativity and the sole desire to expand creativity.

Selfless Refers to a mental state in which personal security and happiness are seen as secondary to a higher purpose. The only purpose which seems to have the potential for producing selflessness is the pursuit of creativity as an end in itself. We can only become selfless by taking our identity from our soul rather than our ego.

Sensors That component of intelligence through which some of the events in the total environment are represented symbolically by Information which is stored in the Memory. In the body, Sensors are visual, auditory, olfactory, kinesthetic, etc.

Sexism An ideology analogous to racism, which ascribes behavioral characteristics to a person solely on the basis of sex. The scientific evidence implies that, although the genetic potential for various types of behavior may not be identically distributed in each sex, the full gamut of human behavior, other than the reproductive functions, probably exists within each sex. The best way to avoid both racism and sexism is to accept each person solely on the basis of individual merit and to avoid *a priori* judgments. Sexism is unethical.

Social Morality Refers to the deliberate desire to help increase the creativity of others. Social morality must co-exist with personal morality or it will become perverted into immoral decency, whereby the person seeks to increase solely the happiness of others. All moral persons have both components of morality, though not necessarily to the same degree. (See **Personal Morality**)

Social Science Any of the numerous attempts to develop scientific models of human behavior, e.g., economics, psychology, and sociology. In fact, most "social science" models are psychofraud which have never been objectively shown to predict or control human behavior, although some of these models, such as Marxism and Fascism, are temporarily popular and "faddish" in the academic community.

Socialism A socio-political system in which every person is forcibly held responsible for the welfare of every other person. The Ethical State is a voluntary socialistic system for each octet, but it does not have an ideological basis as do most of the existing systems which today call themselves "socialistic." In all current socialistic systems, "welfare" is considered synonomous with "happiness." In the Ethical State, "welfare" is synonomous with "creativity." It seems that socialism will not work practically or ethically for groups larger than an octet. Forced socialism, as occurs in democracies and communist states, is unethical. Only libertarianism is politically ethical.

Soul That part of us which takes its identity from our creative actions and is driven solely by love and our desire to maximize creativity. The soul is our true self, which must merge and become one with our ego if we are to be creatively transformed. Unlike the ego, which dies with our body, the soul is immortal, and lives on in the creativity we engender in others. (See **Ego**)

Specialist A specialist is a person who has developed depth of knowledge in one area at the cost of being ignorant in other areas. The specialist differs from the generalist not because of what he knows, but

because of what he does not know. It is possible for a specialist to be more intelligent and have more knowledge in every area than a generalist. When a generalist and a specialist are of comparable intelligence, the generalist is always more creative. It is possible for a generalist to be more creative than a specialist in the specialist's own field, even when the latter is much more intelligent than the former. If a generalist is represented by a sphere and a specialist by an ellipsoid, then their total knowledge, which is a product of their intelligence, is represented by their surface area. Their creativity is a product of both their intelligence and their ethics and is represented by their volume. A sphere or hypersphere has maximum volume for a given surface area for any figure of fixed dimensionality. (See pp. 17–18, 123–25.)

Speciation Refers to the process by which a new generalized phylum starting with a single species fans out into the biosphere by having suceeding generations adapt until they can fit into one and only one ecological niche. Each adaptation represents a new species which is forever separated from its former brothers.

Symbiosis Refers to a process by which two different processes or life forms combine in such a way that their joint entropy is decreased or their collective intelligence is increased in such a way that the joint whole is greater than the sum of its parts.

Symbol Something that stands for something else and in the process encodes information. Letters in an alphabet are manufactured symbols of sounds. Sequences of RNA are non-manufactured, natural symbols that encode information for synthesizing proteins. Everything that exists encodes information within its structure. A machine is its own symbol, a specific manifestation of information for manufacturing more copies of itself.

Tachyons Hypothesized subatomic particles which always travel at speeds in excess of the speed of light. Tachyons accelerate by losing energy until they are traveling at infinite speeds when thay have zero energy. Although the existence of tachyons seems theoretically feasible, they have not as yet been experimentally detected. Tachyons were originally independently postulated by Gerald Feinberg, Isaac Asimov, and Soviet Scientists.

Technology A scientific process for designing, building, and/or operating machines; the application of science to control of the environment.

Total Environment Total environment includes all that can be perceived or conceived. The total environment may be divided for convenience into (1) the physical which includes all of matter and energy; (2) the biological which includes all life forms, and (3) the psychosocial which includes all activities of the mind and the behavior of life forms. These divisions are only a convenience which should vanish with time. Ultimately, it should be shown that matter, life and mind are all interrelated phenomena produced by a single cosmic force. In recent years, the apparent discontinuities between life and matter have been disappearing. Eventually all psychosocial phenomena should be understood in the same manner.

Trivial Refers to activity which neither increases or decreases creativity. Trivial activity will increase entropy. In the long run, trivial activity may decrease creativity indirectly by increasing entropy to the point where creativity is no longer possible. Trivia is a set of measure zero. Almost all actions

are either creative or destructive. (See **Measure Zero**)

Truth Information about a cause and effect relationship is true if and only if it increases one's ability to predict and control the environment when one believes it. All models of cause and effect relationships involve error. Therefore truth is a goal which is approached asymptotically as Information grows. Whoever pursues truth will get ever closer to it. Only an entity who has infinite intelligence knows absolute truth. Even apparently tautological statements may involve semantic errors. (See **Falsehood**)

Unconscious Refers to that state of mind in which we have unpredictable and uncontrollable thoughts. The imagination seems to work primarily at the unconscious level. (See **Conscious**)

Unethical (Evil) Behavior is unethical if and only if it decreases at least one persons's creativity. All unethical behavior is a strategy in the Game of Pleasure. A person is unethical when he plays the Game Of Pleasure more often than he plays the Game of Life. Unethical behavior always increases entropy.

Unethical Society A society is unethical when most of its members are unethical and it is structured to decrease creativity. Every nation is an unethical society or an incipient unethical society. Societies become unethical through bureaucracy, ideology, fear, and unethical leadership.

Uniformly Optimal Strategy A uniformly optimal strategy is a plan for minimizing our risks while simultaneously maximizing expected gains. Following the rules of the Game of Life is a uniformly optimal strategy in both the Game of Pleasure and the Game of Life. (See **Minimax**)

Will That component of intelligence which directs the flow of Information to the other components. Will is a vector quantity with a direction and a magnitude. The direction determines what type of information will be processed, and how; the magnitude determines the resolve to process the information. The Imagination and the Effectors generate events which provide a critical mass of Information until knowledge exists. Under the direction of the Ethical Will, all the components of intelligence operate to expand creativity continuously. Under direction of our animal (pre-ethical) Will, all the components of intelligence operate to increase happiness with no concern for creativity. Will in our bodies appears to be an effect of the three most primitive brains and may be unrelated to the neo-cortex. Our Ethical Will seems to be entirely a product of the neo-cortex. The Will operates at both the conscious and unconscious levels. Ethics program the Will in the evolutionary direction.

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